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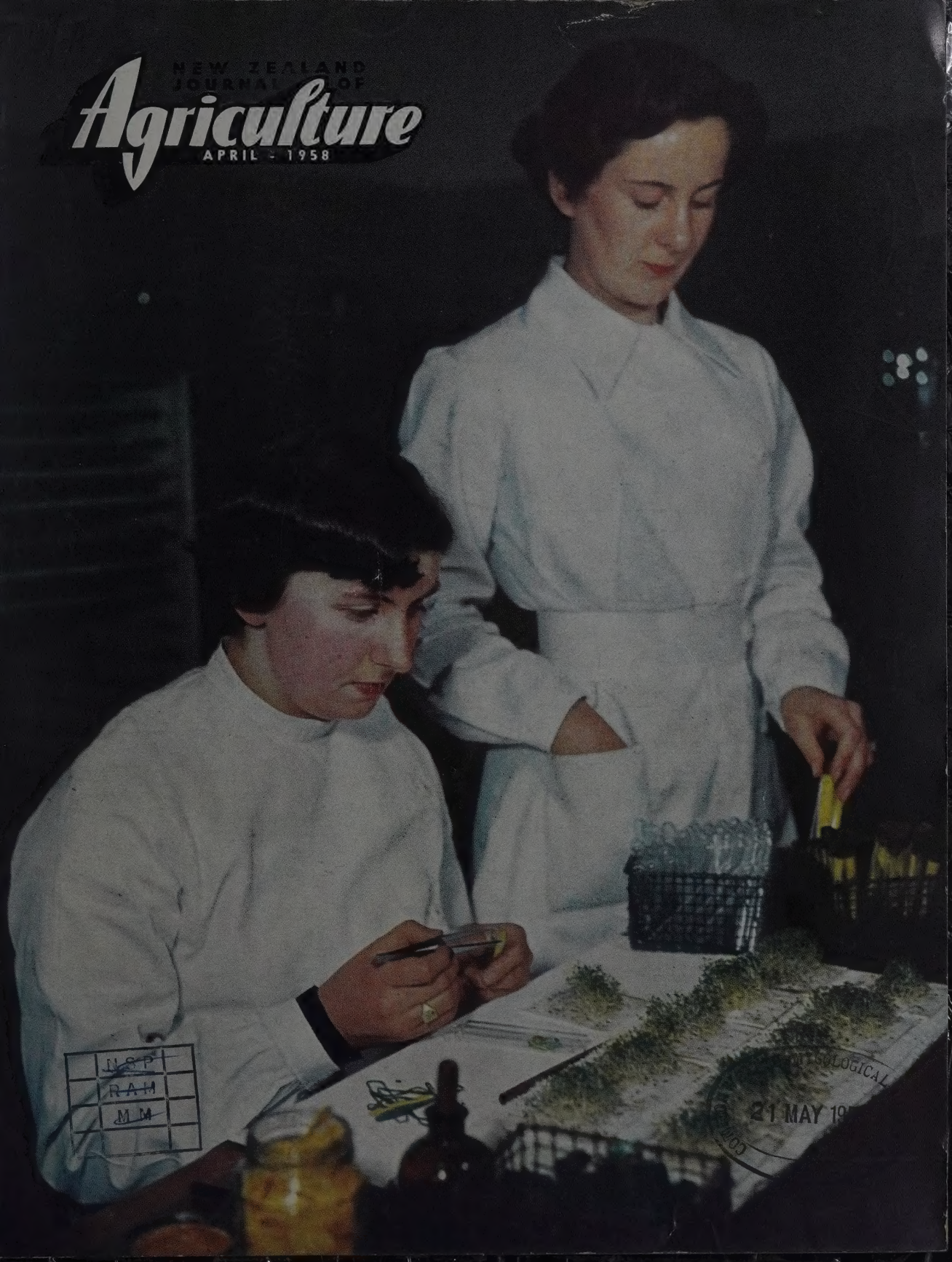

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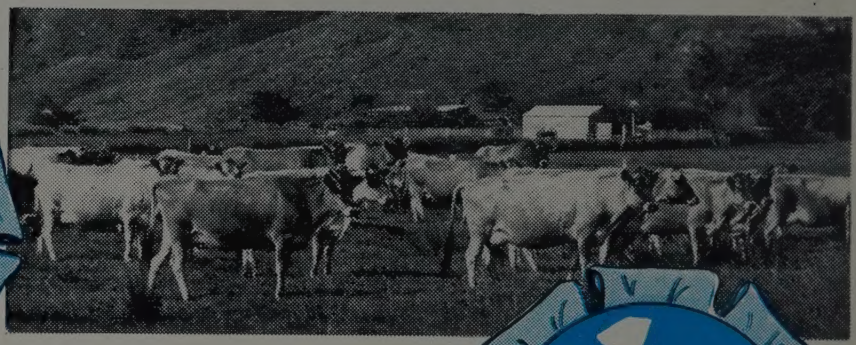

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Volume 96
Number 4
15 April
1958

NEW ZEALAND JOURNAL OF Agriculture
(Established 1910)

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Minister of Agriculture

New Zealand during the last 50 years has gained a reputation for the widespread application of science to farming. Not the least of her accomplishments has been the establishment of a seed-testing service that has so won the confidence of farmers that most of them now accept the need for sowing tested seed. Practically all seed grown in New Zealand is analysed by careful testing at the Department of Agriculture's Seed-testing Station, Palmerston North, as shown on this month's cover. Certificates covering purity and germination that are issued by the Station give buyers in New Zealand and overseas assurance of quality.

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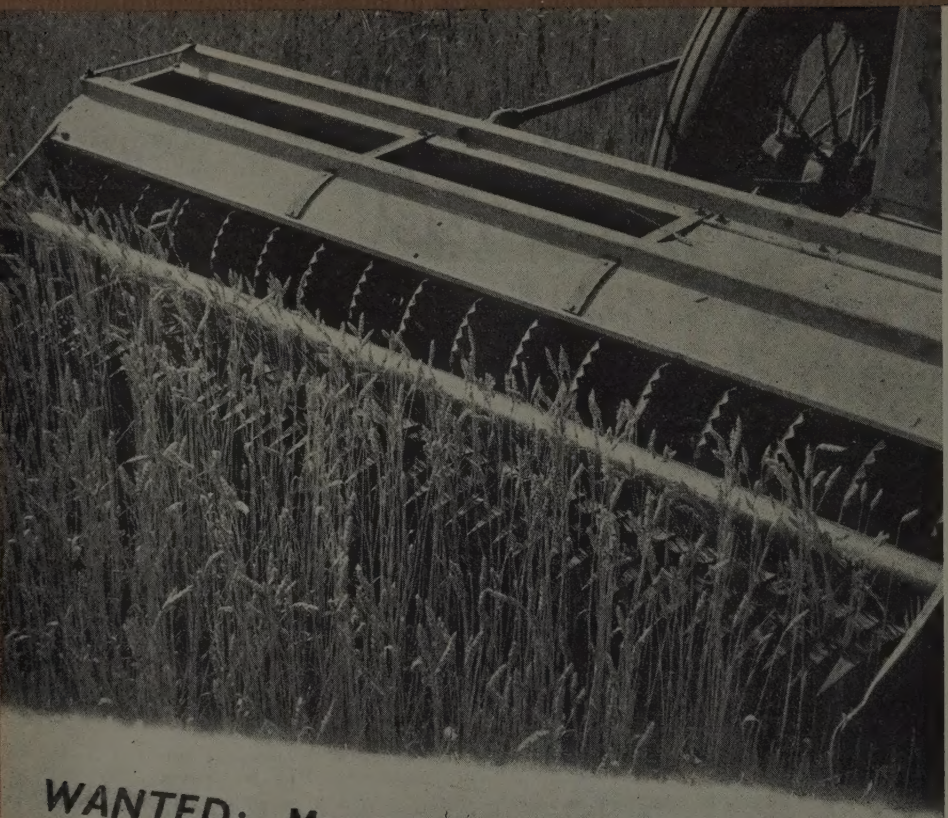
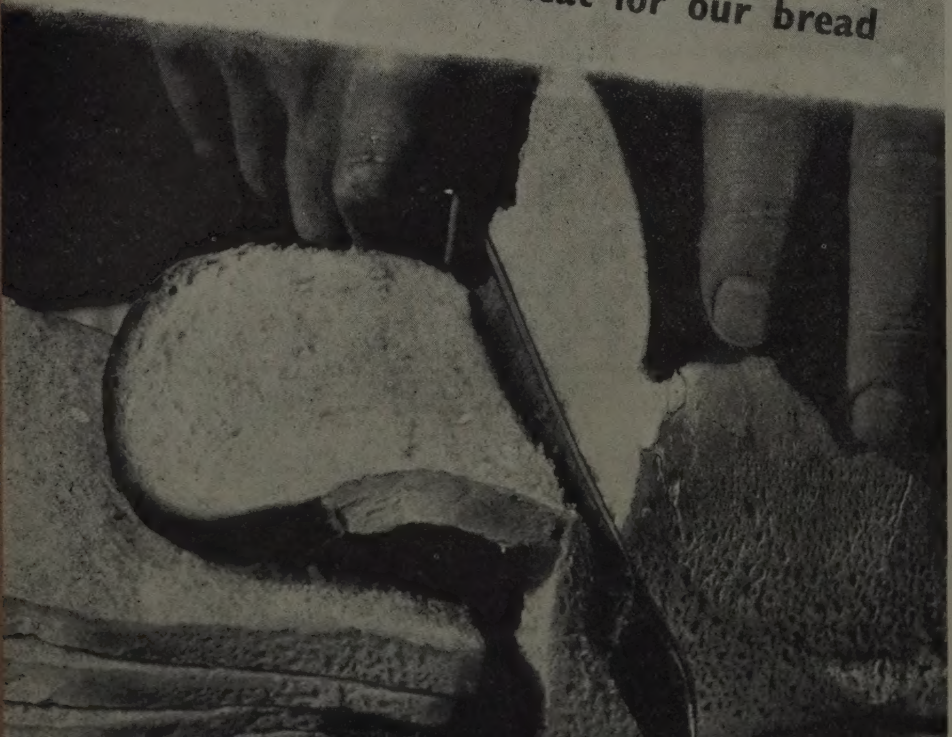


← Improved varieties have made possible the harvesting of most of New Zealand's wheat with the header harvester.
[*National Publicity*

WANTED: More N.Z. wheat for our bread



← Over 8 million bushels of wheat are now required each year for human consumption
[*Johnstone*

Higher Prices, Better Yields

Incentives to Increased Wheat Production

By the EXTENSION DIVISION

TO provide an incentive for an increase in wheat production the Government recently announced that for the 1958-59 season the price of wheat to South Island growers will be increased from 11s. 6d. per bushel to 13s. 6d. per bushel. It is expected that this increase of about 17½ per cent. will result in the sowing of a considerably increased acreage this year.

WITH an increasing population of both humans and poultry there is a continuing increase in the consumption of wheat. During the early 1940s consumption was about 9 million bushels a year. It then increased rapidly to 11 million bushels and now it is about 13 million bushels a year.

Use in 1956 was as follows:

	Bushels
Human foods	8,277,000
Animal food (mainly for poultry)	4,502,000
Seed for resowing ..	117,000
Waste	80,000
Total	12,976,000

It is about 40 years since New Zealand produced enough wheat to satisfy its requirements. Except for occasional years, it has been necessary in the intervening period to import increasing quantities until now 80 per cent. is imported.

The graph below shows the amount produced in New Zealand as a percentage of the total used annually during the last 20 years. Because of reduced production it has been necessary to arrange during the last few years for the importation of from 7 to almost 10 million bushels a year.

New Zealand Production

Though over 300,000 acres of wheat has been grown in New Zealand in a number of seasons, the acreage since the turn of the century has generally ranged from about 220,000 to 250,000 acres. During the last 13 years, however, the area has never been as high as 200,000 acres, and the average annual acreage for the last 3 years has been only 78,000. This is about one-third of the area that was sown 20 to 30 years ago.

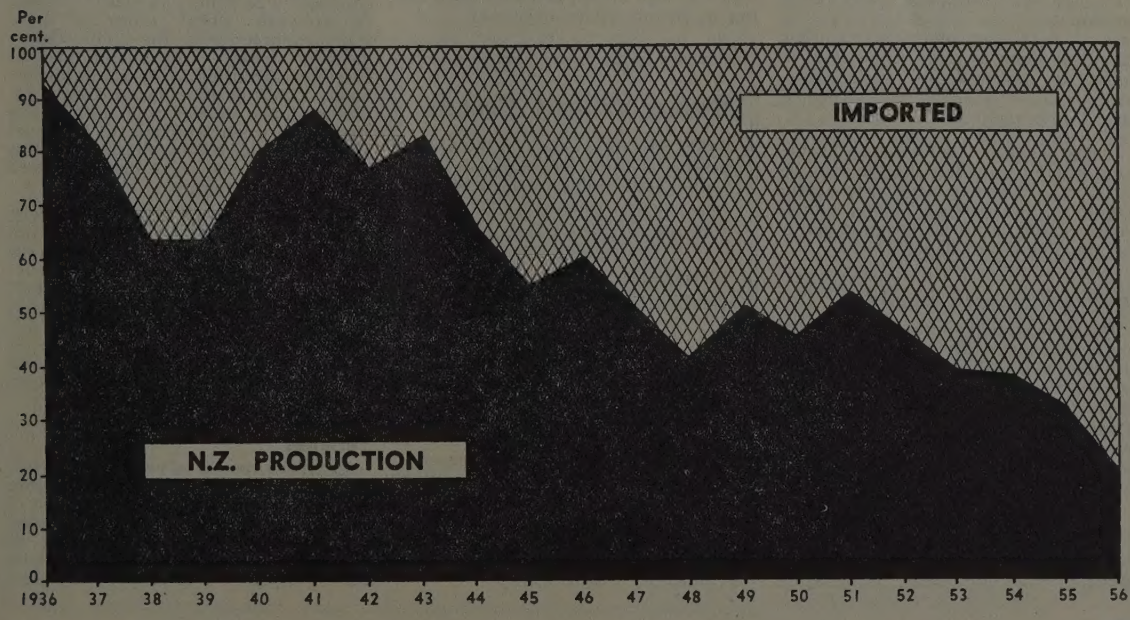
Yields

As would be expected, seasonal conditions play a considerable part in determining yields. For this reason these vary considerably from year to year. Average yields, however, show that spectacular increases in yields have been made, particularly since 1945:

	Average yield bus. per acre
1920-29	31.9
1930-39	31.0
1940-44	32.8
1945-49	37.4
1950-56	40.3

It has been suggested that this increase in yields is due almost entirely to a greater proportion of the wheat being grown on the better land, but a survey carried out in Canterbury showed that this was not so. The explanation for the increase in average yield must therefore be sought elsewhere. There is ample evidence that on many wheat-growing farms yields

PRODUCTION OF WHEAT AS PERCENTAGE OF CONSUMPTION



have been increased very largely as the result of an increase in fertility after the establishment and grazing of improved pasture.

The use of higher yielding non-shattering varieties has also played an important part as has the control of yield-reducing diseases.

Prospects

All the evidence suggests that an expansion of wheat growing associated with high average yields is quite possible without a reduction in the quantity of animal products. This can be done if care is taken in the selection of suitable paddocks, the use of the varieties most suited to the various localities, and the use of the most suitable fertilisers. Any expansion in the growing of wheat will also result in a parallel and advantageous renewal of pastures.

Place in the Rotation

The place of wheat in the crop rotation varies with district practice. Usually the rotation of crops in New Zealand is based on the need for pasture renewal and the provision of supplementary fodder crops.

Cash crops, such as wheat, are fitted into the rotation as is convenient, though definite district practices have been established. Advice on these points is readily available from local district offices of the Department of Agriculture.

Preparation of Land

Preparation of land for wheat varies according to the previous crop. If pasture is to be ploughed up, this should be done as early as possible to permit the turf to decay. In some districts summer fallows are advocated after this ploughing.

Where wheat is to follow an arable crop, discing in of the stubble may be sufficient. The main need is to obtain a well worked seedbed having sufficient consolidation to favour good germination and establishment.

Seeding Rates and Fertilisers

The general practice is to sow 100 lb. to 120 lb. of seed wheat per acre when autumn sowing and a heavier rate when sowing in spring. In Southland up to 150 lb. of seed per acre is used when the crop is spring sown. However, Department of Agriculture trials have shown that rate of seeding is not critical if extremes are avoided.

Wheat responds to high fertility, but where it is grown on land that was previously well stocked and topdressed pasture and on which intervening crops (such as rape, turnips, etc.) received adequate fertiliser it is doubtful if fertiliser need be sown with the seed. However, as an insurance, 1 cwt. per acre of superphosphate or similar phosphatic fertiliser is sometimes recommended for such land. Wheat on land which is inclined to exhibit "spring yellows", a symptom of nitrogen deficiency, may benefit from 1 cwt. of nitrogenous fertiliser, such as sulphate of ammonia. This fertiliser can also be applied as a topdressing in spring where necessary.

[National Publicity

About 4½ million bushels of wheat are required annually for poultry to produce an essential food—eggs.

Basic Wheat Prices

BASIC PRICES for wheat of **14s. 6½d. per bushel in the North Island** and **13s 6d. per bushel in the South Island** were recently announced.

Variations to these basic prices are:

Hilgendorf 2s. per bushel above it;

Yielder 2d. per bushel below it.

All prices are f.o.r., sacks extra.

Fertilisers may be more necessary on land known to have been low in fertility, such as that recently ploughed out of old browntop pasture. For such areas 1 cwt. of phosphatic fertiliser per acre at least is recommended; often 2 cwt. may be payable. A dressing of nitrogenous fertiliser may also be worth while.

Advice on fertiliser requirements for wheat may be obtained from local district offices of the Department.

The results of numerous manurial trials with wheat indicate that there is little danger of germination injury to seed wheat when superphosphate and sulphate of ammonia are drilled with the seed at up to 2 cwt. per acre.

Weed Control

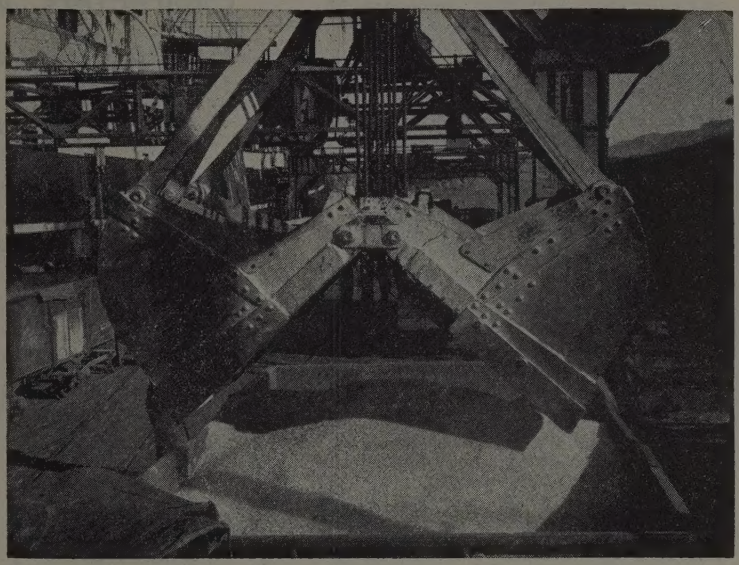
Spraying with hormone-type chemical weedkillers to control weeds in growing wheat crops is now standard practice in the main wheat-growing areas. The choice of the correct weedkiller is of great importance. This is governed not only by the tolerance of the crop but by the species of weed which is to be eliminated. Advice on these aspects should be obtained from local district offices of the Department.

Wheat can be sprayed with safety with the right weedkillers during the period after the development of six true leaves and before the "boot" stage, when the upper sheaths swell before the ears emerge. Weeds arising largely from germinating seeds are sprayed as early as feasible, but weeds, such as Californian thistle, emanating from rootstock regrowths are best treated at a later stage.

Varieties

From the results of recent trial work the Department of Agriculture can recommend with confidence the use of several new varieties. These are Aotea and Arawa for autumn sowing in Canterbury and North Otago and Gabo for spring sowing in the North Island.

VARIETIES FOR VARIOUS DISTRICTS



About 80 per cent. of the wheat used is imported.

Aotea

The variety Aotea was bred at the Crop Research Division, Department of Scientific and Industrial Research. It is recommended as a replacement for Cross 7. Aotea possesses all the desirable field characteristics shown by Cross 7—strength of straw, resistance to lodging, resistance to shaking or shattering of grain when mature, and suitability for direct heading. In addition, however, Aotea has yielded much better than Cross 7. Many careful trials conducted in a number of years and in all appropriate districts indicate that Aotea on the average yielded about 20 per cent. more.

Aotea is very similar to Cross 7 in both grain and growth. Their periods of growth are about the same and Aotea is practically equal to Cross 7 in baking quality.

Only very limited supplies of Aotea seed will be available for the 1958-59 sowing season; a reliable estimate is sufficient for sowing about 15,000 acres. Much more should be available for the next sowing.

Arawa

Arawa, also bred by the Crop Research Division, has already largely displaced Dreadnought on the heavier soils of Canterbury and North Otago. Possessing tall and heavy straw, it approaches Dreadnought in yielding ability. However, Arawa has the great advantage over Dreadnought that it is suitable for direct heading. When mature it stands well and does not lose grain through shaking or shattering. It matures considerably (2 weeks) earlier than Dreadnought.

Experience with Arawa has shown it to be as good as Dreadnought as a grazing wheat, an important aspect in some districts. Arawa is not of good baking quality, though no worse than Dreadnought in this respect.

Compared with Aotea, Arawa has taller and heavier straw and is about equal in maturity. Departmental trials indicate that Aotea has a small but definite advantage in yielding ability on all but the heaviest soils.

For sowing in 1958-59 there should be ample supplies of Arawa seed in the heavier-soil districts of Canterbury and North Otago.

Gabo

Gabo is an Australian variety that matures early and is of good baking quality. For some years it has performed very well in trials in the districts of the North Island where wheat is spring sown. It is recommended for sowing in place of Tainui, which has the defect of tending to lodge when nearing maturity, which causes harvesting difficulties.

Gabo is a shorter, stronger-strawed variety than Tainui and has much better resistance to lodging. This contrast in lodging resistance has been the main feature of trials in which Tainui and Gabo have been compared. The two varieties are about equal in yield and baking quality, but Gabo is earlier in maturity, stands better, and is easier to harvest.

There were commercial crops of Gabo in the North Island in the 1957-58 season and the indications are that from these crops North Island districts will get sufficient seed for 1958-59.

Other Varieties

Cross 7: Cross 7 is likely soon to be superseded by Aotea for autumn sowing in Canterbury and North Otago. Nevertheless, for spring sowing in South Otago and Southland, Cross 7 is likely to remain popular, as it is a good variety producing high yields. It is also still recommended for autumn sowing in the Wairarapa.

Cross 7 has been a remarkably successful variety for 20 years. Its introduction coincided with the adoption of header harvesting, for which it was admirably suited. The widespread production of Cross 7 wheat was responsible for a marked improvement in the baking quality of New Zealand wheat, up to a point where it was very satisfactory.

In some years in Canterbury and North Otago Cross 7 has been susceptible to a root-rot disease which produced symptoms of discoloured or blackened heads containing pinched or even no grain, with consequent loss of yield. The new variety Aotea has not suffered from this condition to anything like the same extent as Cross 7.

Tainui: This variety is recommended for use in North Island spring sowings if Gabo seed is not available.

Hilgendorf: This variety has the special virtue of exceptionally good baking quality. For this reason a premium payment is being made for it. It grows particularly well in Marlborough and in the Barrhill district of

Recommended Wheat Varieties

NORTH ISLAND

Spring sowing: Rangitikei, Manawatu, Hawke's Bay, Wairarapa	Gabo, Tainui
Autumn sowing: Wairarapa	Cross 7

SOUTH ISLAND

Autumn sowing:	
Marlborough	Hilgendorf, Cross 7
Canterbury	Aotea, Arawa (heavy land), Hilgendorf, Cross 7
North Otago	Aotea, Arawa (heavy land), Cross 7
Spring sowing: South Otago, Southland	Cross 7

Mid-Canterbury and is recommended for sowing in those districts, where it approaches Cross 7 in yielding ability. It is distinctly earlier in maturity than Cross 7.

Harvesting

Perhaps no phase of wheat production in New Zealand has undergone such a radical change as the method of harvesting. Before 1930 all the wheat grown was cut with the binder and then stooked. It was either threshed from the stook or was stacked for later threshing as the mill became available. The first header harvesters were introduced into New Zealand in 1930 and it was not many seasons before harvesting methods changed completely.

Header harvesters may be used not only for direct heading, but with an attachment to pick up a crop which has been cut and windrowed. Today most of the wheat is direct headed and this has reduced considerably the cost of harvesting and amount of labour needed. However, the changed methods of harvesting necessitated the selection of varieties suitable for direct heading. This has progressed over the years until today Dreadnought, the last of the older well known varieties not suited to the changed methods of harvesting, is being replaced by the good heading variety Arawa.

Moisture Content

When header harvesters were first introduced into New Zealand it was feared that climatic conditions might not be sufficiently dry to allow the harvesting of grain low enough in moisture content to be bagged without deterioration. For this reason moisture-testing centres were set up by the Wheat Research Institute.

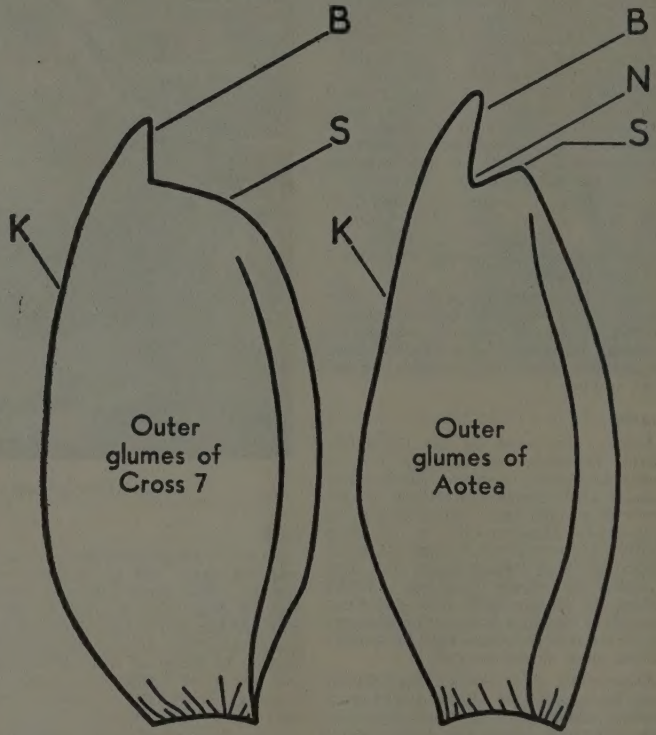
However, since header harvesting was first introduced farmers have become most adept at estimating moisture content in the standing crop and interest in moisture-testing facilities has lapsed. Today they are available only at the Christchurch laboratory of the Wheat Research Institute and the Seed-testing Station of the Department of Agriculture, Palmerston North.

Certification

Since 1927 the Department of Agriculture has conducted a scheme of seed wheat certification. This scheme provides the wheat grower with an adequate source of reliable seed of all the principal varieties and is based on varietal purity and relative freedom from seed-borne diseases, the worst of which is loose smut. The Department has been able to check the incidence of this disease by hot-water treatment of nucleus material.

Ball or stinking smut, another fungous disease, is readily controlled by an organic mercury seed treatment.

Characters which Distinguish Aotea Wheat from Cross 7



Plants of Aotea wheat may be distinguished from those of Cross 7 by the features of the outer glumes of the head.

The glume of Aotea is rather longer than that of Cross 7, with an inflected or concave keel (K), prominent beak (B), and rather narrow, elevated shoulder (S), which frequently has a small notch (N) at the base of the beak. By comparison Cross 7 has a flat to humped keel, rather small beak, and a wide, square shoulder lacking a notch at the base of the beak. For identification, glumes from the middle region of several heads should be examined.

Other characters which may assist in the separation of the two varieties are:

1. The foliage of Aotea is mid-green, in contrast to the yellowish-green foliage of Cross 7.
2. The spikelets are rather well spaced in the head of Aotea, in contrast to the rather compact Cross 7 head.

The grain of Aotea cannot be distinguished from that of Cross 7.

—J. M. McEWAN, Scientific Officer, Crop Research Division, Department of Scientific and Industrial Research, Lincoln

Advantages from Higher Acreage

With the recent substantial increase in price and the introduction of the newer high-yielding varieties, it can no longer be claimed that wheat growing is not profitable. Expenditure of overseas funds on wheat imports has now become an important item in New Zealand's balance of payments problems and every extra bushel grown locally helps to alleviate these problems.

With good returns likely and full technical advisory services available from the Department of Agriculture, farmers in suitable areas should not hesitate to expand their wheat acreage or to embark on wheat growing.

Simplified Queen Bee Rearing

STRONG colonies led by vigorous young queens of good strain are one of the prime essentials of successful commercial beekeeping, and an understanding of the fundamental requirements of the art of queen rearing is a necessity for all beekeepers who depend on beekeeping, either wholly or partly, for their livelihood. In this article D. Roberts, Apiary Instructor, Department of Agriculture, Auckland, describes a method of queen rearing which can be practised successfully by all interested beekeepers who have the necessary facilities. The article will be concluded in next month's issue with a description of the preparation of cell-finishing colonies and hive management to complete this method of queen rearing.

SO much in beekeeping depends on the maintenance of vigorous, well bred queens that beekeepers with a real interest in the craft cannot afford to leave the replacement of this vital member of their colonies to chance. If the replacement of poor or old and failing queens is left to the bees themselves, they will normally effect this replacement to their own satisfaction and in their own time. To the uninitiated this may seem very desirable, but the need to control swarming and to have good colony strength at critical periods make natural requeening unsatisfactory for commercial apiarists.

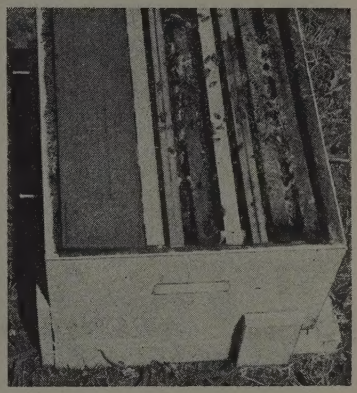
Because honey bees mate only in flight, no rigid control of matings is possible in general practice and the maintenance of a strain containing good brood-rearing, handling, and working qualities calls for constant supervision by the beekeeper. If the rearing of queens is left entirely to the bees, matings with undesirable strains will occur with sufficient frequency to influence quickly the whole of an apiary or even a series of apiaries. Thus in 1 or 2 years an apiary originally stocked with bees showing most desirable traits may be found to have reverted to a condition where the bees are inherently vicious and lack most good qualities.

The maintenance of a good strain of bees is essential if beekeeping is to be both pleasurable and profitable. Though the beekeeper desiring to raise his own queens cannot rigidly control the mating in his apiaries, he can, by rearing queens only from selected stock and by providing an ample force of drones bred from selected mothers, ensure that the greatest proportion of his rearings are of the quality desired.

Ability to Raise Queens

Queen rearing on other than a very small scale and by methods of only limited application has come to be regarded by many beekeepers as the province of only a few highly skilled specialists. This is perhaps largely true of queen rearing on a large commercial scale, but any competent beekeeper who is prepared to give thorough attention to detail and to study the weather and floral conditions of his district can raise queens which will prove entirely satisfactory for honey production.

The method to be described in this article is that developed from earlier practices by Jay Smith, a prominent American breeder. Its chief advantage to the inexperienced, or those with weak or failing eyesight, is that with this method the transference of larvae from brood combs to prepared cell cups, a delicate operation demanding considerable skill and experience, is avoided. A further advantage is that the age of the larvae used for queen rearing can always be readily determined. The method is equally suitable for rearing large or small numbers of queens and the only limitations are those of time and equipment available.



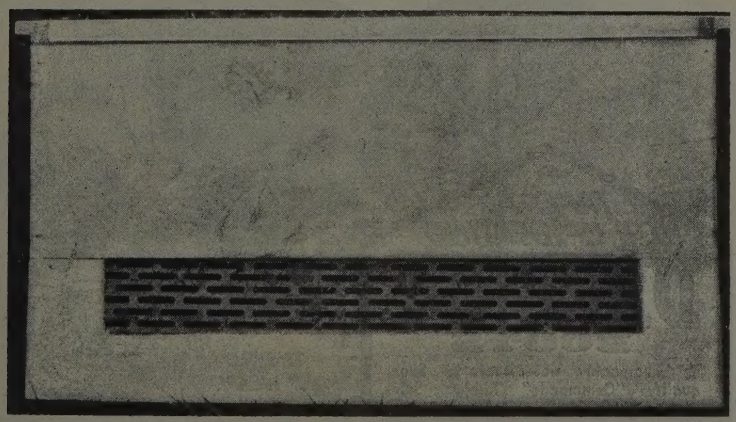
Breeder hive with hardboard cover over queen compartment.

Breeder Queens and Apiary Sites

Because the aim will be to raise queens of inherently good characteristics, the first step in any queen-rearing programme is to select a queen to act as a breeder. Where a good strain has been maintained by the purchase of queens from outside sources a suitable breeder can often be selected from the beekeeper's own stock.

Where the stock is hybrid or exhibits viciousness or other undesirable characteristics a breeder queen should be obtained from a recognised breeder. If this is done, the purchase of a breeder alone will not be sufficient, as good matings cannot be obtained unless the queen-rearing apiary is well stocked with bees producing desirable drones. It is essential in such instances to ensure that the colonies of the apiary chosen for queen rearing are headed by queens of the desired strain so that there will be sufficient drones of the right type to ensure a satisfactory percentage of good matings.

Apiary sites though excellent for honey production may, through local topographical conditions, be entirely unsuited to queen rearing. A suitable queen-rearing site is generally one where there is good shelter from prevailing winds, that is warm and sunny, and where the conformation of the



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surrounding area and the location of trees and shelter belts are such that the flight range of queens on mating flights tends to be restricted to the immediate vicinity.

Consideration must be given, too, to the number of other apiaries in the area. If it is well stocked with bees of a generally good type, a high percentage of good matings is likely to be achieved. Where there are adjacent apiaries containing bees of undesirable strains it may be impossible to get a payable percentage of good matings. In such circumstances another site must be sought, or the owners of the other apiaries must be approached to secure their co-operation in allowing their colonies to be requeened. Where the number of adjacent apiaries is not great such an approach is often welcomed and a good queen-rearing site becomes possible.

When a satisfactory site is found a queen suitable for breeding must be chosen. If the queen is to come from the beekeeper's own stock, several factors must be taken into account in judging its suitability as a breeder.

Choosing Queen

Firstly, the performance of the queen and her colony must be considered. Queens selected for breeding should be prolific enough to maintain a strong colony of workers and produce compact brood with only very few empty cells showing among the sealed brood. Her offspring should all be evenly coloured and should be quiet on the comb and of as even temper as possible. They should be good honey gatherers and tend to build good, even combs; they should not tend to gather unduly large amounts of propolis or to swarm excessively.

Irrespective of age the queen should be well proportioned with a symmetically shaped abdomen and should move sedately over the combs. A queen showing abnormalities in body, wing, or leg structure should not be used.

Though a queen may display excellent outward characteristics, her value as a breeder can be confirmed only when stocks have been raised from her and she has been proved to have a good inheritance factor. Thus a queen selected to act as a breeder cannot be considered successful until at least two seasons old.

Queens when originally selected for breeding should be marked in some way, either by clipping of one wing or by the use of marking paint so that possible supersedure can be determined easily. They should be kept in colonies where their egg laying can be kept to a reasonable level so that their life as a breeder is extended as long as possible.

New Bee Combs Essential

In this method of queen rearing the breeder queen is compelled to lay in newly drawn comb specially prepared for the purpose. Once the eggs are laid the comb is removed from the compartment where the queen is kept and is held in another part of the hive until the eggs have hatched and the larvae are 24 hours old. The comb containing the larvae is then cut into strips which are fastened to cell bars and given to a cell-starting colony.

The reason for using newly drawn comb is that fresh comb is much more easily shaped into queen cells by the bees than old, tough comb which may contain the cast-off skins of larvae. By using strips of comb in this way the operator is assured that the larvae chosen are of the correct age. The need for transferring or grafting larvae from the comb in which they were hatched to prepared cell cups is avoided and the technique of queen rearing much simplified.

Compartment for Breeder Queen

The breeder queen is kept in a prepared hive fitted with a specially made division board. The division board is of wood with a strip of zinc queen excluder 2 in. to 4 in. wide fitted the length of the division board 2 in. from the bottom. The top of the division board is made flush with the top edges of the super so that a mat or cover will prevent the queen from passing from one section to another. The division board is placed so that space is left on one side of the super for three combs and on the other for six.

Breeder hive with canvas mat attached to division board and folded back.

The queen is kept in the smaller space, of which the entrance is blocked, and the larger is filled with combs of capped and emerging brood and honey and pollen. Initially, the smaller space is filled with two specially prepared frames each containing a piece of comb 9 in. x 5in., the rest of the space being filled in with wood. This gives the queen only a very limited space in which to lay and when the third space has been filled with a specially drawn comb it is quickly laid in.

In practice it will be found that the use of brood combs well filled with brood will be equally as satisfactory as the special wood-filled frames. If the breeder is to be used for a considerable period, it will be necessary as the brood hatches to replace the brood combs with other combs well filled with brood so that the laying of the queen is restricted at all times.

Colony Strength Maintained

As the breeder colony will not have much emerging brood of its own, it must be strengthened either by the addition of combs of hatching brood from a neighbouring colony or by the introduction of young bees. This should be done at least once a week.

A strong force of young bees must be maintained in the breeder colony at all times, as it is bees from 5 to 14 days old which provide the food for the newly hatched larvae. If good, healthy, vigorous queens are to be produced, the larvae from which they are raised must be flooded with food from birth and this can be done only when the colony has a strong force of bees of the right age and ample honey and pollen. Breeder colonies should be fed with either liquid honey or sugar syrup the whole time they are used for raising queens, irrespective of whether there is a nectar flow or not.

Control of Egg Laying

Once the breeder colony has been established in the prepared hive the process can be initiated and from then on it becomes routine. The queen will be found to lay more readily in the prepared combs if these are not given until she has been held in the small compartment for 3 days.

The combs to be used for making the strips are prepared by fitting standard Hoffman frames with 8 in. x 4 in. pieces of medium brood foundation. These pieces must be drawn out

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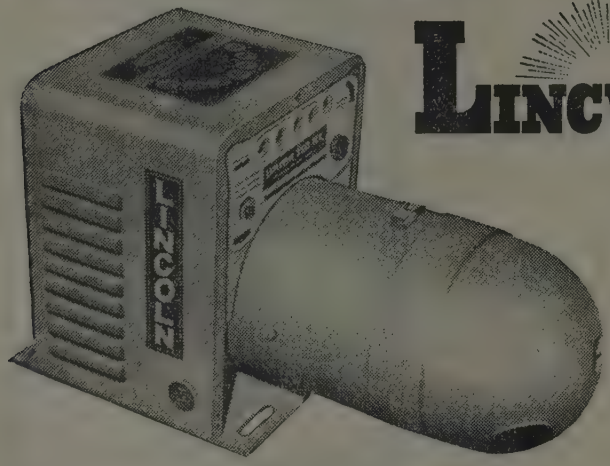

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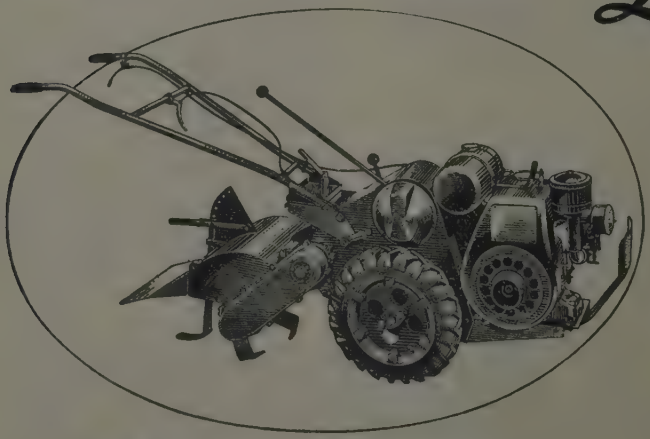

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before being given to the queen. This can be done in the larger chamber of the breeder colony. The procedure is as follows: The drawn comb is removed from the larger chamber to the queen chamber and a further prepared frame of foundation put in its place in the larger chamber. Twenty-four hours later the drawn comb should be fully laid in by the queen. It is then withdrawn, marked with the date, and returned to the larger chamber until the larvae hatch, its place being taken with the second prepared frame, which will now be drawn out. This process is continued until the fourth day, when the eggs laid in the first comb will have hatched and the larvae be of the correct age for use. In this way a continual supply of combs with larvae is assured.

The next step is the preparation of the strips and their attachment to cell bars ready for placement in a cell-starting colony or swarm box. The starter colony or swarm box, whichever is used, must be prepared a few hours before the cells are introduced. With this method the use of a starter colony or swarm box to start the cells and then removal of the cells to a queenless cell-finishing colony will give better results than the use of one colony to both start and finish the cells.

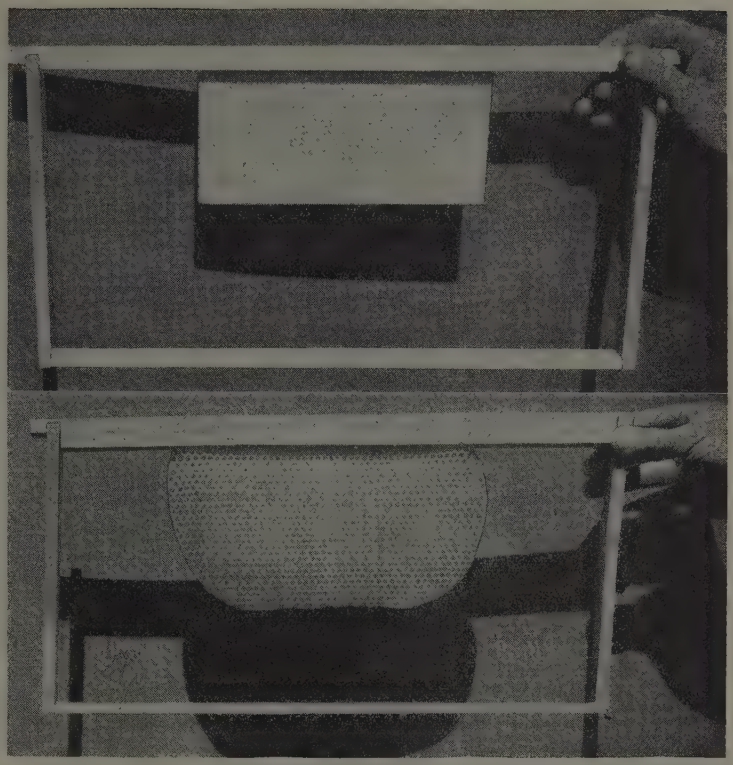
Cell-starter Colony

The queenless starting colony is made up from a very strong colony which has been working on a nectar flow or has been fed over the past 2 days or more. The queen and all but two frames of young unsealed larvae are removed. The frames of larvae are placed in the centre of the super, leaving a space between to take one frame of pollen. The remainder of the super is filled with empty combs and combs of honey. The colony must be sufficiently strong to cover all frames. This type of starter colony can be used effectively for up to a week, but after that it will become progressively less effective as the bees age and their efficiency as nurses decreases.

Swarm Box Method

The swarm box starter colony is a built up one. It consists of a box 18 in. deep to hold five standard brood frames. The bottom 6 in. of the box is left open on each side and screened with wire gauze. There is no entrance and the bees are confined the whole time they are in the box. To stock the box, bees are taken from the upper brood chamber of strong 2-storey colonies, which have either been working on a good nectar flow or have been fed in the same way as the cell-starter colony.

To be certain of obtaining the right proportion of young bees the brood of the chosen colonies is re-arranged the day previously. The unsealed brood is lifted into the second storey above an excluder, leaving the queens



Upper—Comb foundation attached to frame ready to be drawn out by the bees. Lower—Foundation drawn out by the bees and ready for placing in queen compartment.

below. When the swarm box is filled the bees are shaken only from these combs above the excluder. Five to six pounds of bees, the equivalent of a strong single-storey colony, will be sufficient for starting up to 50 cells.

When the swarm box is filled a comb of honey is placed next to each wall and a comb of pollen placed in the centre space. A feeder of weak sugar or honey syrup is placed on top and the swarm box stood in a cool, dark place. Such a swarm box will start up to three groups of cells, after which the bees should be returned to the colonies from which they were taken and the box refilled.

Cutting and Fixing Comb Strips

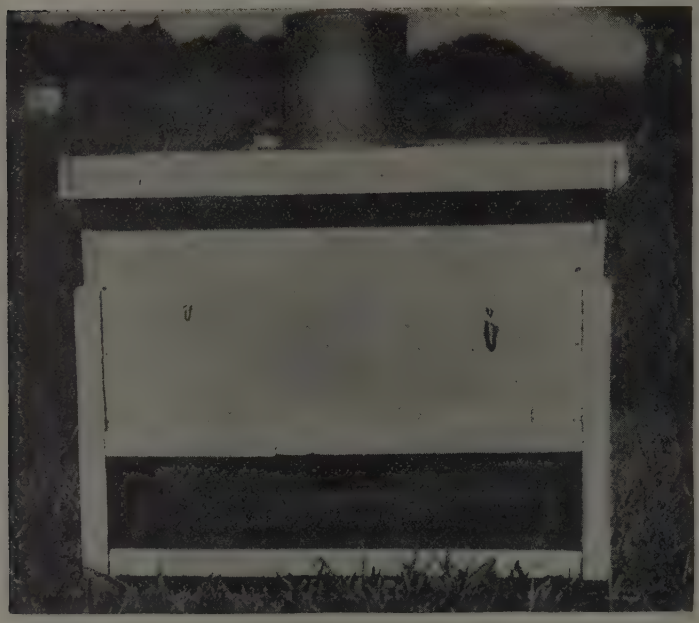
With the cell starters ready the preparation of the strips containing young larvae and their attachment to cell bars are undertaken. Great care must be taken when handling the prepared combs of larvae to see that they are not exposed to bright sunlight or are allowed to become chilled or to dry out.

The work of cutting the comb into strips and attaching them to cell bars is best done in a shed where temperatures are even. If a shed is not available, the cab of a truck or a closed car will provide a satisfactory substitute. As the work should be done without delay, all necessary material should be assembled before a start is made.

The prepared comb is cut lengthwise into strips each containing one row of cells. Strips are then attached to the cell bars with melted wax. The wax should be thoroughly clean and free from impurities. To avoid the risk of damage to the delicate larvae by heat the wax should not be used until it has cooled sufficiently to allow a film to form on the surface. The strips must be well attached to the bars, as, should they become loose, the bees will tear them down. The cell bars are best given a good coating of wax before the strips are placed in position.

When the strips have been firmly fixed some of the larvae must be destroyed to permit sufficient spacing for the building of good-sized queen cells. If every third larvae is left, spacing should be adequate. A 3 in. nail or similar piece of metal will make a good tool for killing unwanted larvae.

SIMPLIFIED QUEEN BEE REARING



Swarm box ready to receive comb strips containing young larvae.

An alternative method of attaching the prepared strips of comb to the cell bars which is quicker and avoids the risk of overheating the larvae with molten wax is to use two thin pieces of soft wood. The wooden strips are prepared beforehand by being coated all over with two or three layers of wax. They are used in pairs into one of which are driven six ¾ in. panel pins so that the points project ¼ in. The cells on the unused side of the strip of comb are laid on the piece of wood without the pins. The piece of wood with the pins is then laid on top and the two pressed firmly together.

The wooden strips can be prepared at any time previously and their use obviates the need for heating wax in the apiary. If this method is used, care must be taken that the cells which are to be converted to queen cells project sufficiently far beyond the wooden strips to allow a good base to be built. If the cells do not project far enough, the young queens may be damaged when the cells are removed from the bars.

Starting Queen Cells

As soon as the cell bars are ready they are placed in the starter colony or in a swarm box. With the starter colony procedure the two frames of larvae left are removed before the operator begins formation of the cell bars, which are placed in the vacant space immediately they are prepared. If the swarm box is used, it is given a quick jar to shake the bees to the bottom, the lid is removed, and the cell bars are put in the spaces between the honey and pollen.

Twenty-four hours later the cells are ready for removal to the cell-finishing colonies. During transfer from the starter colony to the finishing hive the cell bars must **not** be shaken or held in any position other than that in which they normally hang in the hive. Any adhering bees may be lightly brushed away.

Twenty-four hours after being given to the starter colonies the cells are transferred to cell-builder or finishing colonies.

(To be continued)

Director of Rukuhia Soil Research Station Retires

ONE of New Zealand's best known agricultural chemists, Mr R. E. R. Grimmett, Superintendent of the Department of Agriculture's Rukuhia Soil Research Station, retired on 31 March. He had completed more than 40 years' service with the Department of Agriculture which included notable work on mineral deficiencies.

Born and educated in Nelson, Mr Grimmett joined the Department in Wellington in 1917. He completed his B.Sc. degree at Victoria University in 1922 and M.Sc. the next year, when he became Analyst in the Chemistry Section of the Department.

Bush Sickness Investigation

In 1926 Mr Grimmett went to Rotorua to assist the late Mr B. C. Aston in investigations into the cause of "bush sickness", which for many years had hindered the development of farming on much of the pumice country in the central part of the North Island. Though his work did not result in the determination of the primary cause of the disease, it did result in one method of controlling bush sickness by the use of limonite, which was later found to contain cobalt, the ultimate remedy.

Soil Research

In 1927 Mr Grimmett visited the Rowett Research Institute, Aberdeen, in connection with research into the mineral content of pastures. He did some of the earliest work on the availability of manganese in soils.

Mr Grimmett returned to New Zealand in 1928 and in 1936 became Officer in Charge of the Chemical Laboratory, Wellington, and Chief Agricultural Chemist the following year. He transferred to the newly created Animal Research Division in 1939 and took part in early research on facial eczema at Ruakura Animal Research Station.

Soil-testing Service

When the Rukuhia Soil Research Station was formed in 1946 Mr Grimmett was put in charge. Though the station has been established for only a relatively short time, it has made noteworthy contributions to agricultural progress. Probably its major achievement has been the development of a soil-testing service for farmers throughout New Zealand. Other work has been concerned with soil chemistry, development of peat land, and irrigation.

Mr Grimmett was president of the New Zealand Society of Soil Science in 1954.

Profitable Use of Meals in Pig Feeding

AT this time of the year many farmers will not have sufficient milk or whey to take all their summer litters up to porker weights and a decision must be made as to whether supplementary food should be purchased to get as many pigs as possible up to market weight. In this article E. D. Edwards, Technical Officer, Department of Agriculture, Wellington, discusses the management and economic aspects of this situation.

EVEN on well organised farms the problem arises of how to find sufficient food to feed at a profit to the pigs remaining in autumn. Because of the difficulties they face many farmers prefer the easy road of taking the unfinished pigs through winter as stores or of selling them on a weak market. These alternatives are never very profitable. Further, the store period increases the difficulty of marketing the quality of carcass that is required.

Before spending money on purchased foods to finish off the second-litter pigs as porkers the farmer has to consider what these pigs have cost him in being brought to the weaner stage and their value to him locally as stores, underweight porkers, or porkers. He must consider what would be their likely value as stores in spring and what provision he has made for an adequate supply of pigs from May and June litters to cope effectively with his spring flush of skimmed milk. He is then aware of the limits to which it would pay him to buy food to supplement home-produced food and so obtain the greatest value from his milk or whey in the immediate future.

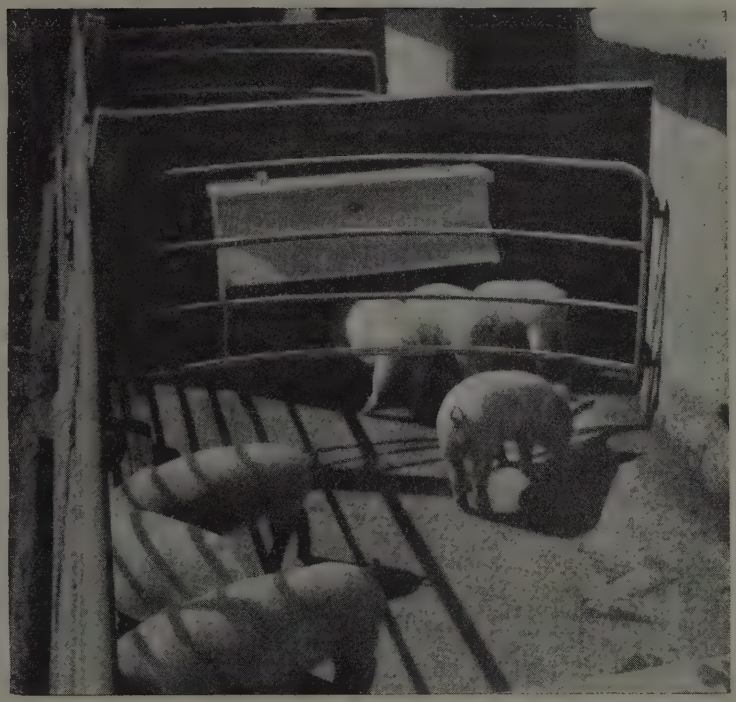
Planning for Maximum Returns

Profits are influenced by such things as the earliness or lateness of the season, the size of litters, the fitness of pigs on hand to use the feed supply available, the amount of home-grown feed and time at which it is used, the weather, the health of the pigs and the attention given to them, and the amount of purchased meal used. It is not easy, therefore, for the individual farmer to say how profitable a certain outlay on purchased meals has been.

Research and farm studies show that dairy by-products fed to pigs can be used most efficiently when supplemented with both farm-grown foods and purchased foods at appropriate times of the year. Farmers should endeavour to plan production so that the outlay on meals is fully justified.

Time of Farrowing

Time of farrowing is important because of the seasonal nature of the skimmed milk or whey supply and because this feed cannot be stored very satisfactorily; because two litters per sow each year are needed for maximum profits; and because it determines how much out-of-season food (and thus the use of expensive foods) is needed.



Meal is used most efficiently at this stage in the pigs' growth. It should be readily available in a creep protected from the sow and the weather.

When farrowings are evenly spread over the year too many store pigs have to be wintered; usually these are underfed during the coldest weather, when the greater part of the food eaten must go toward maintaining body warmth. Such a spread of farrowings is not recommended unless the pigs are suitably housed and fed to gain weight and there is a favourable market nearby.

A better policy is to run 1 sow to 10 cows and to concentrate farrowing in May, June, and July and again 6 months later, finishing most of the pigs from the first litters as baconers and those from the second as porkers. With this system the period of maximum food requirement coincides with the flush of skimmed milk or whey. Some meal will be needed, particularly in winter, but there is less difficulty in finishing second-litter pigs.

A new approach to the problem of coping with second litters is to wean first litters early and so advance second litters by a month or so. This necessitates replacing sows after two litters or holding them back from the boar till January or February to get back to a May or June farrowing.

When to Feed Meals

An important principle of animal growth is that as an animal grows an increasing proportion of its food is required for body maintenance. Since this portion of the food is unproductive in the sense that no meat or milk is being produced from it, the younger animal makes more efficient and profitable use of its food for growth than the older.

Expensive foods should therefore be fed to pigs in the creep and, at least when rapid growth is wanted, to weaners. Sows usually require some meal as part of the ration during and immediately after rearing of a large litter to ensure regular farrowings of strong, healthy litters.

The price of meals in relation to that of pigmeat not only restricts the use of meal to the more efficient classes of pigs but limits the amount of meal which can be included in the rations of these animals. Full feeding on

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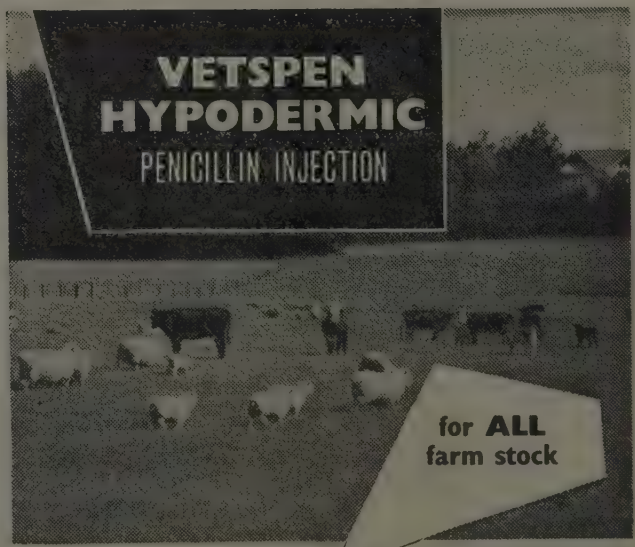

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meals is seldom profitable except for short periods where under good management the resulting increase in pigmeat commands a comparatively high value or the alternative would be a prolonged period of slow growth or store stage.

Food Value of Meals

As about a third of all dairy farmers with pigs feed no meals, one must assume that under their system of management meals give no better net income than that from milk or whey alone. Expensive weaners, for example, ones resulting from small numbers weaned per sow, and wasteful feeding methods do not allow meals to be used profitably. Such limitations must be removed before full advantage can be taken of meals as a supplement.

Waste of meals in storage and during feeding must be reduced to a minimum. Another form of waste, perhaps less obvious on individual farms, is that resulting from, firstly, unsatisfactory housing and, secondly, inferior stock. Warm, sanitary housing with sufficient trough space is always desirable; breeding stock should be selected from animals which convert their food efficiently.

To obtain the maximum value from meals fed to pigs the rations containing the meal need to be adequately balanced with essential nutrients and fed in amounts sufficient to promote adequate growth-rate. A guide to the optimum ration for fattening pigs is given in Table 1. It should enable farmers to decide whether their pigs are being seriously underfed or overfed. The table shows the amount of supplement needed to maintain the requisite growth.

TABLE 1—RATIONS FOR FATTENING PIGS

Liveweight	Approximate age	Feed units required daily per pig
lb.	weeks	
40 ..	.. 8	2.0
60 ..	.. 11½	2.75
80 ..	.. 14	3.25
100 ..	.. 16	3.75
120 ..	.. 18	4.25
140 ..	.. 20	4.75
160 ..	.. 22	5.25
180 ..	.. 24	5.75
200 ..	.. 26	6.00

Feed Unit System

Some knowledge of the amounts of various foods that are equivalent to 1 food unit is necessary not only for working out the correct ration but for comparing the prices of meals available.

TABLE 2—AMOUNTS OF VARIOUS PIG FOODS TO PROVIDE 1 FOOD UNIT

Foods rich in protein

1 gallon of skimmed milk or buttermilk
1 lb. of meat meal (60 per cent. protein)
1 lb. of pea meal
1 lb. of linseed meal
¼ gallon of mother liquor of whey

Foods deficient in protein

1⅓ gallons of whey
1 lb. of maize, barley, or wheat
1¾ lb. of pollard or oats
1¾ lb. of bran
⅔ lb. of tallow
1¼ lb. of molasses
5 lb. of potatoes (boiled)
5 lb. of sugar beet
6 lb. of artichokes
7 lb. of fodder beet
8 lb. of carrots
10 lb. of pumpkins, swedes, or mangels

The protein required by pigs for flesh formation can be met by supplying ¾ to 1 gallon of skimmed milk or ½ lb. of meat meal daily. The protein-deficient foods shown in Table 2 must be supplemented by sufficient of the foods rich in protein to meet this requirement.

Value of Home-grown Foods

To make money spent on meal go further home-grown foods can provide bulk in the ration and part at least of the maintenance requirements for periods when dairy by-products are in short supply. The most important farm-grown feed in New Zealand is pasture, on which many pigs are expected to thrive. Breeding stock may obtain the equivalent in food value of 2 gallons of milk from good pasture, but its value for fattening pigs is mainly from the exercise and health improvement the grazing affords. However, when meals are being fed to pigs on pasture sufficient grass to satisfy the appetite reduces the intake of the expensive supplements.

In spite of the wide variety of crops which can be grown for pigs, cropping is not practised extensively partly, no doubt, because of the greater reliance on pasture by dairy farmers and labour costs. Where crops are grown for cows they are usually suitable for feeding to pigs, at least to sows. Even where crops for cows are not normally grown, it would be a sound investment to grow one of several types for pigs.

The key to successful pig production is in the feeding and management of the breeding herd. If this is attended to first, the farmer is very soon encouraged to take better care of the progeny by feeding them properly to achieve a rapid turnover of stock. Having a crop in reserve in autumn is a valuable safeguard against underfed pigs, particularly sows, and permits more efficient and economical use of meals in supplementing a rapidly diminishing supply of skimmed milk or whey.

Amount of Supplementary Foods Required

The immediate problem is to provide enough food to take autumn pigs up to market weight and show a profit. Meal feeding is desirable, but is payable only when management is efficient.

When management is good the most profitable use of the skimmed milk from a dairy herd will be obtained when about ⅛ acre of crop is grown for every sow kept and 1 cwt. of meal is used per cow milked. If meal is used at a heavier rate, this must be accompanied by an increase in the cheaper, home-grown foods.

Net Returns from Meal Feeding

The recommendation on the amount of meal which should be used is based on information recorded on farms about 25 years ago. An indication that under normal conditions it still applies is evident from a study of the net returns achieved by a number of farmers feeding skimmed milk to pigs during the 1955-56 and 1956-57 seasons. For some farms the results for both seasons are available. The net returns were calculated by valuing the pigmeat produced at 1s. 6d. per pound and deducting the costs of food used other than skimmed milk. These costs were based on ruling prices of bought foods and estimates for crops and pasture.

In Table 3 the results are arranged in three groups according to the level of meal feeding. Though efficiency varies between farms, practically all the farmers have reached a high standard of production as measured by the output of pigmeat per 100 lb. of butterfat.

Two important points from this table are:

1. Meal used at about ¼ cwt. per cow to support a high level of production

TABLE 3—AVERAGE NET RETURNS FROM PIGS ON HOME-SEPARATION FARMS ACCORDING TO THE AMOUNT OF MEAL USED

Group	Meal used per cow		Number of results	Number of farms	Net returns (after deducting cost of supplements used)					Pigmeat per 100 lb. butterfat
	Range	Average			Per sow	Per cow	Per manhour	Per gallon skimmed milk	Per lb. butterfat	
	lb.	lb.			£ s. d.	£ s. d.	£ s. d.	d.	d.	lb.
1 ..	0-50	20	11	8	73 9 10	9 3 11	1 15 0	4.4	8.3	48
2 ..	51-150	99	7	6	75 14 3	10 16 4	1 7 7	4.7	8.3	54
3 ..	Over 150	188	5	4	57 15 11	8 12 2	1 4 2	4.0	7.1	56

MEALS FOR PIGS . . .

provides very good return for labour.

2. Net returns are greatest when about 1 cwt. of meal per cow is fed.

Under present price relationships, recommendations on meal feeding must take into account labour supply and efficiency of food conversion on farms. When labour is at a premium, as in recent years, and dairy farmers are prosperous the labour and facilities available for pigs govern production and a system of management is followed which requires comparatively small amounts of meal. Where labour is not the prime consideration there is a tendency for more meal to be bought, but the efficiency with which this extra meal is used governs the profits and hence the amount which should be fed.

The management which produced the results given in Table 3 is perhaps best illustrated by the average farm return after allowing for the cost of meal in three groups according to the quantity of meal fed and assuming a standard herd size of 64 cows.

Group 1 farms would run 8 sows giving 12 litters with farrowings spread fairly evenly throughout the year; net income (to nearest £ based on per-cow return): £588.

Group 2 farms would run 9 sows giving 15 litters, 9 of which would be farrowed in May, June, July and November, December, January quarters; net income: £692.

Group 3 farms would run 10 sows giving 18 litters, but only 8 of these would be farrowed in the period shown for Group 2 farms; net income: £551.

Though only about half of the farms in each group grew crops, those in Group 3 which did so grew almost twice as much as other farms, but only the equivalent of about 1/16 acre of fodder beet per sow.

Table 3 shows that the output of pigmeat per unit of butterfat also increases with the amount of meal fed. This increase in physical efficiency results from a better balance of foodstuffs (at least until 1 cwt. of meal per cow is used) and a heavier stocking rate with emphasis on porker production.

If farmers buy more than 1 cwt. of meal per cow rather than provide some home-grown foods, profits diminish accordingly. A balance must be struck between these two types of supplements.

The pigs from Group 3 farms are mainly sold as porkers to butchers and bring about 2d. a pound of pigmeat more than the schedule price for pork. The farrowing programme adopted by these farmers is arranged to suit this local market. However, even with their higher value for pigmeat Group 3 farms show a lower net income than Group 1 and 2 farms which use much less meal.

Recommendations

If meal is to be used profitably in finishing off pigs as porkers in autumn it is desirable to have:

1. A cheaply produced pig; that is, a home-bred pig from a sow which is breeding regularly and rearing litters of at least 7 pigs.

2. A reserve of home-grown foods to reduce the intake of expensive foods and yet ensure that pigs are adequately fed.

If these conditions are fulfilled, meal can be fed at up to 1 lb. per pig daily over the fattening period to counter a fall in the supply of skimmed milk or whey. Supplements required in excess of 1 food unit per day can be provided more profitably from home-grown foods than by using meal. However, when farm crops are not available but housing is good a higher rate of meal feeding for a limited period to finish pigs which would otherwise go into a long store period will be profitable. This, of course, to a certain extent depends on the May and June farrowings providing ample pigs to cope efficiently with the spring flush of skimmed milk.

When the pig intended for fattening is relatively expensive (owing to its purchase price or its being from a small litter or one in which losses were high) and when insufficient or no cheap food is available there is little scope for payable use of meal. In fact profits may be so small as to discourage use of it.

When food is short it is better to feed the pigs nearest to market weight on an adequate ration and so be able to market them quickly than to keep all pigs on short rations on which all are making very slow progress.

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during January 1958 and for the 6 months ended 31 January 1958 with comparative figures for the same month and the 6 months of 1956-57 have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:

BUTTER

Period	Creamery (tons)	Whey (tons)	Total (tons)	Percentage Inc.
January 1958	21,877	365	22,242	—
January 1957	21,077	387	21,464	—
Increase or decrease	+800	—22	+778	+3.624
6 months ended 31/1/58	127,376	1,952	129,328	—
6 months ended 31/1/57	116,982	1,963	118,945	—
Increase or decrease	+10,394	—11	+10,383	+8.729

Butter in store at 31 January 1958 was 31,994 tons

CHEESE

Period	White (tons)	Coloured (tons)	Total (tons)	Percentage Inc. or dec.
January 1958	10,380	1,839	12,219	—
January 1957	11,140	1,530	12,670	—
Increase or decrease	—760	+309	—451	—3.559
6 months ended 31/1/58	51,946	8,860	60,806	—
6 months ended 31/1/57	52,127	7,454	59,581	—
Increase or decrease	—181	+1,406	+1,225	+2.056

Cheese in store at 31 January 1958 was 25,273 tons

If these figures are converted into butterfat equivalent, there is an increase of 7.501 per cent. in butterfat graded for the 6 months as compared with the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place from time to time they are not necessarily a true indication of production trends.

Ruakura Farmers' Conference Week

The tenth Farmers' Conference Week of the Department of Agriculture's Animal Research Station, Ruakura, will open at Ruakura on Tuesday 17 June and continue until Friday 20 June. As in past years, on the first day subjects of interest to sheep farmers will be dealt with and the field day will follow on Wednesday 18 June. Sheep and dairy farmers are catered for on Thursday; Friday is a special day for dairy farmers.

Winter Show Dates

14, 15, 16, and 17 May—Whakatane A. and P. at Whakatane.

*27, 28, 29, 30, 31 May, 2 and 3 June—Waikato Winter Show at Hamilton.

*29, 30, and 31 May, 2 and 3 June—Otago A. and P. at Dunedin.

*11, 12, 13, and 14 June—Taranaki A. and P. at New Plymouth.

12, 13, and 14 June—Te Kuiti and District Winter Show at Te Kuiti.

24, 25, 26, 27, and 28 June—Whangarei A. and P. Winter Exhibition at Whangarei.

* The Department of Agriculture exhibit will be staged at this show.

Wool Sales

The dates and venues of wool sales are:

21 April: Christchurch **19 May:** Auckland.

26 April: Invercargill. **24 May:** Napier.

30 April: Dunedin. **28 May:** Wellington.

15 May: Wanganui.

Eucalyptus Trees for New Zealand Farms

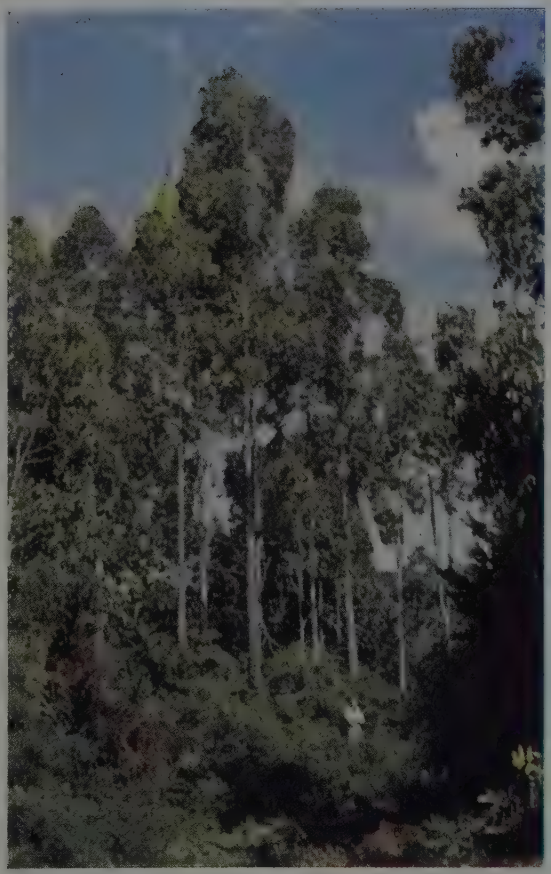
By F. B. McWHANNELL

EVEN to the few gifted botanists who have made the eucalyptus trees their special study, the genus is a complex and confusing one. There are so many species, so closely allied in botanical characteristics, yet so widely divergent in their timber yield and in their soil and climatic demands, that it is small wonder the ordinary man is often led astray by the bewildering conflict of species and varieties. The farmer-planter does not, as a rule, want to bother with technicalities. When he plants a tree he wants to know what it will do for him and he wants this information in as simple a form as possible. With eucalypts he wants to know three things: What species are available, where they will grow, and what timbers they will yield. In this article an attempt is made to present this information as concisely and as simply as possible, without any technical botanical "trimmings".

THE aim has been to compile a list of the more useful species most likely to succeed in New Zealand conditions, a list that will serve as a guide to the inquiring planter. In each case the type of soil in which maximum vigour can be expected is given. Many of the trees, however, have a tolerance which can be fully exploited by the enterprising planter. He, no doubt, will know that though trees may not make the same vigorous growth when planted in less suitable soils than those indicated, they will probably compensate in timber quality for any lack of bulk. As timber yield is the farmer's main concern, this aspect is emphasised, but care has been taken to avoid exaggerated claims for these timbers; indeed the claims are understated.

The short descriptions do not aim to give complete coverage of the species dealt with, nor is the list necessarily complete. For the farmer who wants to try out new species there is ample room for experiment.

E. fastigata breakwind near Tauranga.



E. eugenioides 16 years old, spot sown in gorse and fern.

E. eugenioides: White stringybark
E. muelleriana: Yellow stringybark

These two good trees are the best of the stringybarks. They yield timbers of proved ground durability and of high-class milling quality. They can be profitably and confidently grown as fencing material, for board, gate, and yard timber, and for any other timber purpose where strength and durability are desired. Both are moderately hardy and able to withstand winter frosts of from 10 to 12 degrees. If seed from selected acclimatised trees is used, there is every possibility that the climatic range can be considerably extended.

Eugenioides is slow to move in its infant stages, but once established will grow to large size. *Muelleriana* is a more rapid beginner and quickly attains big-tree dimensions. *Eugenioides* demands a well drained soil with free subsoil. *Muelleriana* prefers heavier country and grows well in clays and in papa. Both species are able to grow in moderately exposed coastal areas.

E. fastigata: Cut-tail stringybark
E. obliqua: Tasmanian stringybark
E. blaxlandi: Blaxland's stringybark
E. capitellata: Brown stringybark

These four stringybarks are inferior in timber quality to white and yellow stringybark; nevertheless, they are

Stable timber: *E. blakelyi.*

Unstable timber: *E. viminalis.*

Sawn 4 in. x 1 in. timber from *E. fastigata* (left), *E. macarthuri* (middle), and *E. saligna* (right).

useful trees in localities where the better trees will not grow. Though their timbers are lacking in ground durability and are lighter in weight than the other two, they are all good milling subjects and can fill a need that cannot be met by the heavier hardwoods.

All four are hardy and can live in the colder areas where winter frosts reach 18 to 20 degrees. Some are rather frost tender in the early stages of life and should be nursed through the first winter, but thereafter they are able to stand alone and will endure very cold conditions. They all prefer good, free, well drained soils with generous rainfall, but they will also grow in clays, though not so vigorously.

Capitellata is able to stand exposure to strong salt winds and can thus fill a need in coastal areas. Both *fastigata* and *obliqua* are fast growers in congenial conditions and are capable of being milled into good board timber, always provided that they are grown under proper management. These two and *blaxlandi* are frequently sawn into 4 in. x 1 in. boards for farm gates. *Capitellata* has been milled into very good flooring. All these timbers split readily and make good fencing battens.

E. macarthuri: Swamp woollybutt
E. viminalis: Manna gum

These are two eucalypts which can be grown where better species cannot live or where for one reason or another better trees are not desired. They have been planted very extensively in New Zealand, but are of little commercial value. They are vigorous growers, and where conditions suit them and they have room to develop they can reach noble proportions and handsome aspect. Their timbers are moderately ground durable and suitable for temporary fencing only. Straight-grained trees can be split into strong and useful battens.

Their milling qualities are unpredictable. One tree may yield good, stable timber, whereas timber cut from another grown in the same locality under the same conditions may be fantastically contorted. They are very easy trees to grow in practically any soil conditions and they will stand up to severe winter temperatures. Both timbers make excellent fuel when thoroughly dry.

E. resinifera: Forest mahogany
E. robusta: Swamp mahogany

These are two useful trees for coastal planting or for areas not far removed from the seaboard. In their best forms both are large trees. Moderately hardy, their frost limit is about 10 degrees. *Resinifera* will grow in light, sandy soils and *robusta* does well in wet country, such as marine flats or in inland swamp areas not too far from the sea.

Both trees produce handsome, red timbers. *Robusta* is suitable for fencing and *resinifera* for milling. There are degenerate forms of *robusta*, particularly in the North Island and these trees should be avoided as seed sources.

E. maideni: Mountain blue gum
E. goniocalyx: Spotted mountain gum

These two large trees will grow in cold areas. Their climatic classification would be hardy. Both are standing up to 20-degree frosts. Trees raised from carefully selected seed would probably live in even colder conditions. They are adaptable trees and seem to be doing as well in warm areas as in cold. Both are also growing promisingly in coastal localities subject to saline influence.

They yield good hardwood timbers which can be expected to last in the ground for 20 years or so. These timbers have been milled into large cuts such as bridge deckings with complete success. Both prefer deep, free soils which need not necessarily be good, but they grow satisfactorily also in moist clays. *Maideni* does not appear to dislike peat.

E. globulus: Tasmanian blue gum

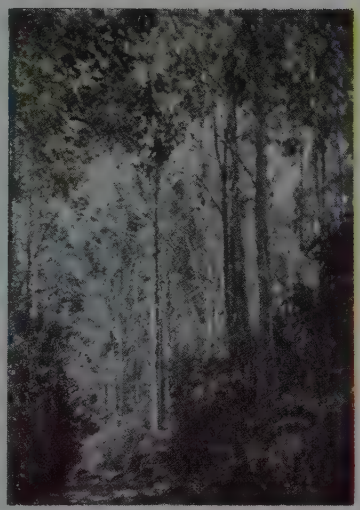
This tree, mainly through errors in siting, has been so generally disappointing in New Zealand that would-be planters regard it warily. The situation has been further confused by planters accepting a close but inferior relative (*bicostata*) as true *globulus*. Siting errors have induced attack by insect enemies and the tree has fallen into considerable disrepute.

Correctly sited, *globulus* can be a very valuable tree. It can, and very often does, grow with vigour and freedom from disease. Its timber is hard and strong and ground durable. It is useful for posts, piles, or any other ground work where strength and durability are required. The timber has demonstrated in innumerable instances ability to last well over 30 years in trying situations as fencing strainers. It has been milled into first-class bridge deckings and has stood up to heavy wear.

Seedlings of the tree are hardy and will withstand severe frosts. A deep, alluvial soil adjacent to the seaboard is necessary. The species dislikes lime.

E. rudderi 15 years old, Waikato.

E. gigantea, Southland.



E. pilularis and *E. saligna* 17 years old.

E. tereticornis (blakelyi): Red iron gum
E. tereticornis (umbellata): Forest red gum

Two distinct species were at one time known under the single specific name *tereticornis*. These two trees were later separated and given the names *blakelyi* and *umbellata* respectively. The old name is still frequently used, with the more accurate name in brackets. The difference between the two trees is in size and environment. Their timbers are practically identical and to the layman their botanical aspects are similar.

Blakelyi is a small to medium tree which likes good, heavy country that does not dry out too much. It should never be planted far away from moisture. *Umbellata* is a much larger tree and prefers a well drained, loamy soil. It can live in much drier conditions than can *blakelyi*. It is also known to be growing well in clays. Both are hardy trees and will exist in cold and exposed localities. Neither objects to warmer and more humid areas.

The timbers of these species are of exceptional merit; very hard, heavy, and close-grained, they have outstanding ground durability and in some North Island localities are known to be still sound after just on 50 years in the ground. Both trees have been milled into boards, but this timber, owing to its extreme hardness, is difficult to handle.

E. saligna: Sydney blue gum
E. grandis: Rose gum
E. deanei: Deane's gum

These are three closely related "gum" eucalypts. In suitable conditions they grow quickly into large, very handsome, shaft-like trees of considerable worth. All like fairly good, free soils in high-rainfall areas. They will also grow in moist clays. Growth in such clays is not as good as in better soils, but there appears to be ample evidence that timber cut from the clay-grown trees is of better quality. *Grandis* appears to be able to thrive in light sandy soils in coastal areas.

The timbers of these trees are good, particularly for milling. Excellent material has been cut from suitably mature *saligna* trees. All three trees are moderately hardy and will withstand frosts of up to 12 degrees.

E. maculata: Spotted gum
E. diversicolor: Karri

These two trees have an interest beyond the casual, in view of the difficulty in New Zealand of growing suitably fast-growing flooring timbers. The milled timbers of *maculata* and *diversicolor* are of world renown and of high commercial value. Both are first-class flooring timbers.

For ground work neither is satisfactory. In spite of their great strength and general appearance of extreme durability they will not last in the ground beyond a few years, but for all above-ground work where toughness and wearing qualities are demanded, they are difficult to equal.

Maculata is extremely frost tender, especially as a seedling, and can be grown only in localities where frosts do not exceed a few degrees. It is a slow grower in clay, but in good, deep soils it grows very rapidly and soon reaches large size. *Diversicolor* is a hardier and more adaptable tree. It will endure frosts of up to 11 degrees and it will grow in a variety of soils from pumice sands to clays.

E. rostrata: River red gum
E. ovata: Swamp gum

These are two useful trees for very wet situations. Both can survive in areas which are waterlogged for considerable periods of the year. *Rostrata* is the better timber tree. Its timber is famed for its ground durability. The species will grow to great size, with a tendency to girth rather than to height. In its native home it has to endure winter frosts of some severity, but it does not seem to have been tried very far south in this country.

Rostrata must have water if it is to grow with any vigour. Creek banks and wet flats are its natural home.

Ovata, on the other hand, is an extraordinarily adaptable tree. It will grow with as much vigour on dry land as in wet. It is able to stand up to severe exposure

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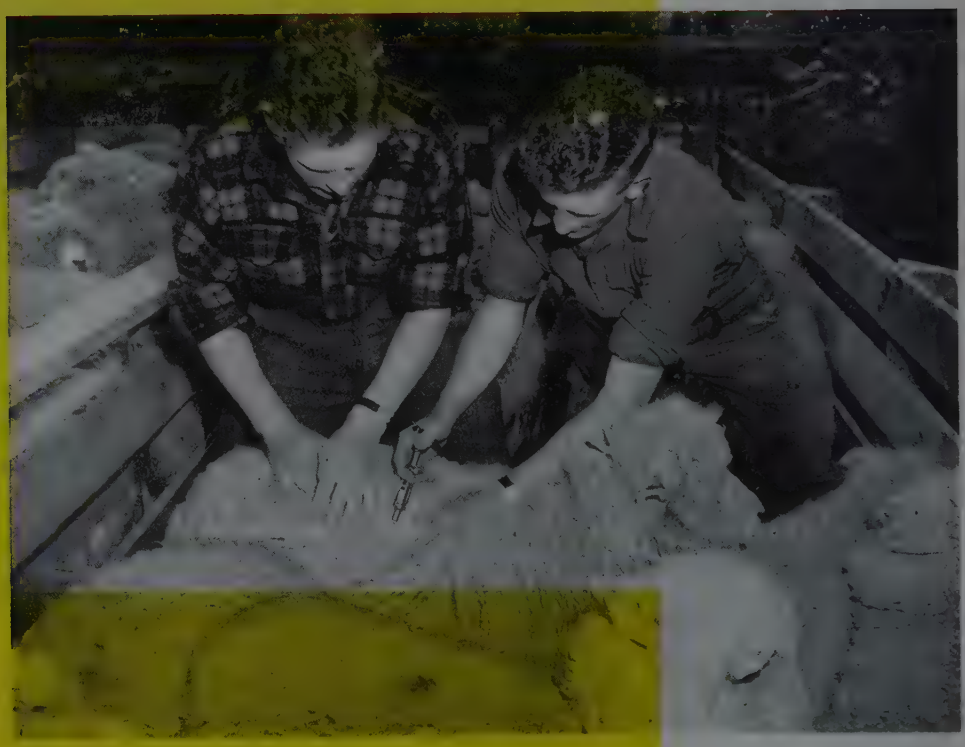

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and hard frosts. It is strongly branched and foliaceous and so makes a good windbreak in exposed areas. It is the eucalypt above all others which will thrive in raw peat swamps. Its timber is tough and strong, of interlocked grain, and of satisfactory ground durability. It will not mill into boards, but for bulkier cuts it is of considerable value. There are many degenerate types of *ovata* and some inferior varieties. Seed from such trees should not be sown.

E. fraxinoides: White ash
E. oreades: Blue mountain ash
E. sieberiana: Mountain ash
E. regnans: Giant gum
E. gigantea: Red mountain ash

These are five "ash" eucalypts, all of them yielding lightweight hardwoods of considerable milling value, especially for board timber. They are more easily handled than the heavier hardwoods, but they lack ground durability. All grow to large size and all have a preference for free, fertile soils with adequate rainfall. *Sieberiana* will tolerate clays and will grow in coastal areas.

All are free splitters and make useful batten trees. The first four are hardy and will grow in cold areas. The fifth is one of the hardiest timber eucalypts growing in New Zealand and is doing well in the far south of the South Island.

E. punctata: Grey iron gum
E. gomphocephla: Tuart gum

These two "gums" produce valuable timbers of great ground durability, but they can be grown only in the warmer areas where frosts do not exceed 10 degrees or so. They have a preference for the more substantial soils and appear to be happiest in clays of various kinds.

Punctata has failed in lighter and drier soils and it should therefore be kept near moisture. *Gomphocephla* appears to be more tolerant and shows promise in lighter coastal soils and in situations exposed to salt winds. Both timbers are exceptionally ground durable.

E. cladocalyx: Sugar gum

This is a moderately hardy tree which appears to be able to withstand frosts of up to 12 degrees. Trees grown from selected seed may prove capable of existing in even colder conditions.

Cladocalyx grows well in the lighter soils and also does exceedingly well in papa country. It has also been seen growing with vigour in clay country. In papa it has been noted as making successive annual height growths of up to 7 ft. Its timber is very hard, strong, and heavy and of excellent ground durability. The species is one which should be much more widely cultivated in suitable areas.

E. sideroxylon 17 years old, Waikato.

E. pilularis: Blackbutt

This very good tree appears to be at its best in clay country, where it grows to great size and yields first-class timber of proved ground durability and of exceptional milling quality. The tree also grows well in lighter country, but there its timber does not, so far, show the exceptional qualities of the clay-grown variety.

Pilularis is one of the most difficult of the eucalypts to handle and, where possible, seed should be sown in situ. Once it makes up its mind to live the tree grows with tremendous vigour. It is frost tender and can be grown only with difficulty below the Bombay Hills line in Auckland Province. It would, of course, grow in selected localities, mostly coastal, south of that line and young trees are reported to be growing well at Hundalee in North Canterbury. It is a good tree for coastal situations subject to trying saline winds.

E. polyanthemos: Red box
E. melliodora: Yellow box
E. baueriana: Blue box
E. microcarpa: Grey box
E. rudderi: Coast box
E. albens: White box

"Box" eucalypts are recognised as producers of first-class timbers prized for their qualities of ground endurance. These timbers are widely used in Australia for fencing material and very long lives are attributed to them. Many of the boxes have shown adaptability in New Zealand, but the promise in their response to conditions here has not been heeded. Few farms possess specimens of any of them, yet they are among the most useful and the most beautiful of the eucalypts.

Early settlers in New South Wales always accepted the presence of box trees as an indication of good land and it behoves the New Zealand planter to be kind in his selection of sites for these trees. They can be established without difficulty in districts where frosts are as severe as 10 degrees.

Seed selection has already shown that one species at least (*microcarpa*) can be grown in a district where frosts of up to 15 degrees occur. *Polyanthemos*, *melliodora*, and *rudderi* are trees of exceptional beauty and are particularly well suited for growing as individual or

E. nitens 10 years old, Waikato.

E. microcorys 3 years old, Waikato.

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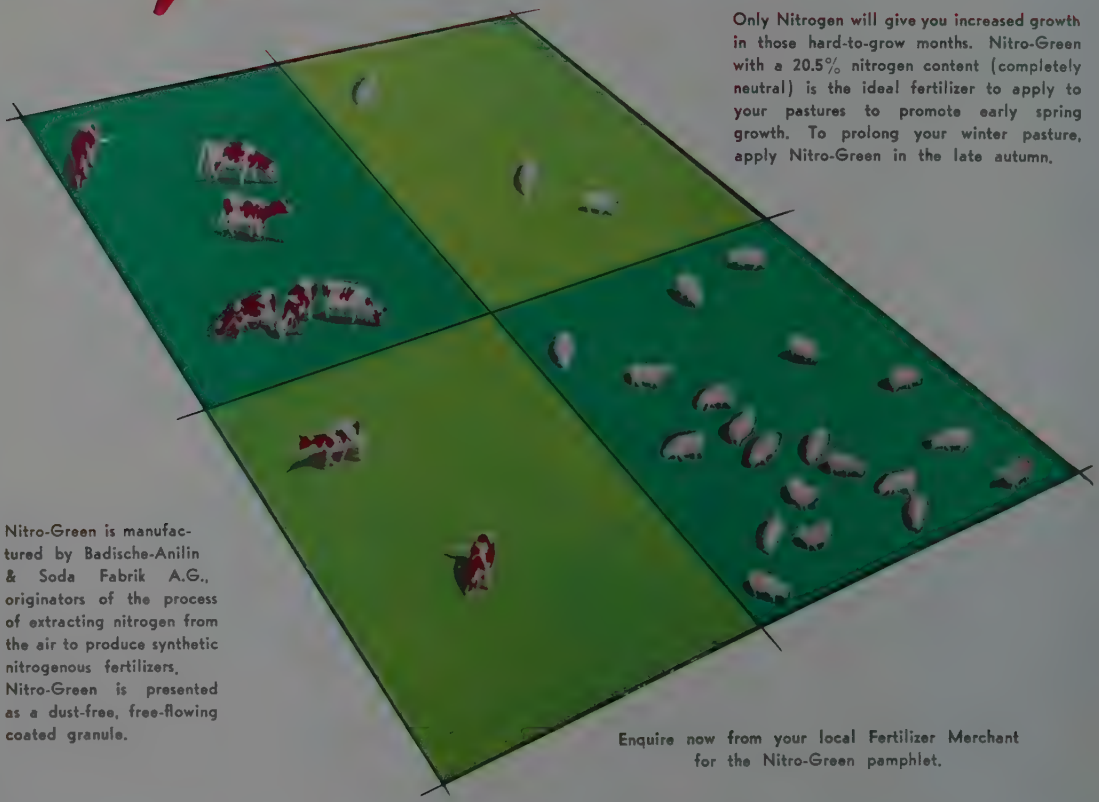

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specimen trees in positions where they have a chance to show their symmetrical forms and their dense and attractive foliage.

E. bosistoana: Bosisto's box

This tree is not included with the other boxes, because it is a much bigger tree and a coarser one. It can grow in colder conditions than its group relatives, too. Its timber is hard and strong, ground durable, and well suited for growing as fencing material. It does not possess the finer texture of the other boxes, but this is of little account in a fence post. It is growing well in clays and in free soils and it is enduring frosts of up to 16 degrees.

E. botryoides: Bastard mahogany

This species is probably the most popular among the better-timbered eucalypts being grown today. It owes its popularity to its adaptability as regards soil conditions, to rapidity of growth and ease of handling, and to timber worth. It will grow in practically any soil, from sand to clay, and it will grow in raw peat. It is a remarkably quick grower, especially in good soils where (near Whakatane) it has reached a height of 50 ft. or so in 4 years.

The timber is a little coarse, reddish, strong, and durable in the ground. *Botryoides* belongs to the select band of trees which, when young, yield reasonably ground-durable timber. Sixteen-year-old trees are known to have yielded poles which were still sound in the ground 14 years later.

The climatic range of the tree is gradually creeping south and young trees are now reported as surviving 15 degrees of frost. Seed selection from trees acclimatised to the colder areas will probably take the range further south still. There are degenerate types and some inferior varieties of the species, and these should be avoided by seed collectors.

E. microcorys: Tallowwood

This tree is possibly the most beautiful of all the timber eucalypts. It carries a densely packed head of delicate, purple-bronze foliage which immediately attracts the attention. In open situations it spreads into a shapely

E. ficifolia, Hamilton.

tree which is unexcelled as a shade provider. It grows to large size and yields a timber that is prized throughout the world for its manifold virtues. This timber is exceedingly ground durable and as a milling subject has few equals. In Australia it is used, when available, for general building, for framing of all kinds, and above all as flooring.

There are only young trees of this species in New Zealand. They are growing promisingly in several parts of the North Island as far south as the Waikato and on the east coast and the Bay of Plenty. Many planters in other areas could grow the tree if sheltered sites were selected. It prefers a fairly good, free soil, but it will also grow in papa and in friable clays. This tree must have a bright future in this country, where the need for good hardwoods is acute.

E. longifolia: Woollybutt

This is a little-known tree that is showing promise in damp situations and in difficult clays that retain moisture. This large, handsome tree with drooping foliage yields a red, very strong, and ground-durable timber. It is known to endure frosts of up to 12 degrees. It has been seen growing in lighter soils, but its growth there has not been impressive. Its home appears to be the moister clays.

E. botryoides 21 years old, Waikato.

E. saligna 24 years old, Bay of Plenty.

E. gunni: Cider gum

This is the most cold-resisting of the timber eucalypts tried in New Zealand. It grows well in the southernmost parts of the South Island and on the cold North Island plateaux. Its timber is of moderate quality and suitable for fencing material. The tree will grow in most soils. It will not grow in warm or humid localities. Its rightful place is in the cold areas where it can experience severe winter frosts.

E. paniculata: Grey ironbark
E. siderophloia: Broad-leaved ironbark
E. crebra: Narrow-leaved ironbark

Several ironbarks additional to the above have been tried in New Zealand, but they have not responded very well to the conditions. These three and the red ironbark (*sideroxylon*)

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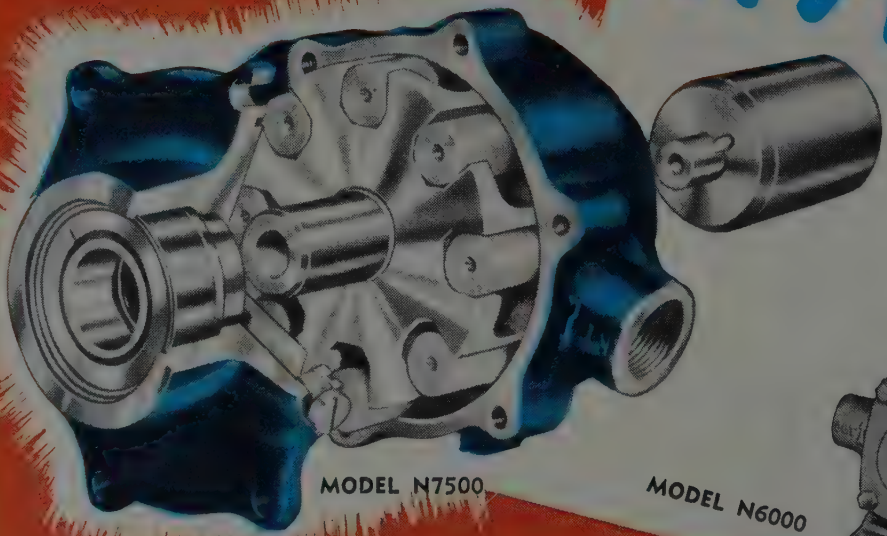

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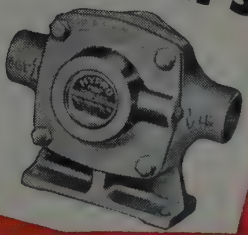

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Gate posts of *E. blakelyi* (red iron gum) still sound after 48 years in the ground on a Waikato farm.

are those most likely to succeed. Ironbark timbers are renowned for their qualities of strength and endurance and they are most desirable trees to grow on any farm. Unfortunately, their climatic range is limited and not many farmers possess the rather exacting conditions they demand.

Crebra is a difficult tree to establish and its growth in this country, so far, has not been impressive. It may well be that the atmosphere is too humid for it, as its natural home is the dry and arid interior of Australia. Its best testing ground would be in dry areas with mild winter frosts and in deep, loamy soils.

Both *paniculata* and *siderophloia* are more amenable trees. Both appear to be happy in both clays and in free soils, and they have grown to useful size in Northland clays and in Bay of Plenty loams. Young trees of both species are growing well in Poverty Bay and in the Waikato. *Paniculata* appears to be the hardier of the two and it is enduring frosts of 10 degrees without harm.

Paniculata has made best growth in loamy soils with clay subsoils and *siderophloia* seems to be happiest in poor clays. All three of these trees produce the very best of the ironbark timbers and the New Zealand-grown product compares very favourably with Australian grown.

E. sideroxylon: Red ironbark

Though this tree is a true ironbark, its timber product does not possess the extraordinary strength and durability of the three species mentioned above. It is, nevertheless, a very good timber which will last in the ground for a long time and give good service as fencing material.

E. globulus post after 26 years in ground.

The tree is known to be growing in districts having winter frosts of up to 19 degrees. It has been seen as far south as Christchurch. It prefers a deep, loamy soil and there it will grow into a big tree. It is not happy in clays and will almost certainly fail unless its roots can go down without much opposition.

E. amygdalina: Black peppermint
E. tasmanica: Silver peppermint
E. piperita: Sydney peppermint
E. andrewsi: New England peppermint
E. dives: Blue peppermint
E. numerosa: River peppermint
E. radiata: Weeping peppermint

These are the main members of the "peppermint" group of eucalypts grown in New Zealand. The trees are of little timber worth, the best of them being *amygdalina*. The foliage of most of them is rich in oils, but this is an aspect of eucalyptus culture which does not, at the moment, interest New Zealand.

Some of the peppermints have an aesthetic appeal. *Dives* has foliage with a bluish tinge; *Tasmanica's* young foliage has a glaucous or silvery bloom; *radiata* has drooping or weeping branchlets and foliage; and *amygdalina* possesses fine, feathery foliage. Most of them, however, become scrawny and age soon dims their beauty.

Peppermints like free soils and some of them will grow in very poor country. All listed above are hardy and will endure severe frosts. The timber of *amygdalina* is hard and heavy and moderately ground durable. It can be used as fencing material. The timbers of the other species are of little use except as battens. *Radiata* has been milled into gate timber of very fair quality. Experience may show that some of the others will mill as well.

E. nitens: Silver-top gum

This tree appears to be a vigorous grower in both warm and cold climates and it seems to have a real liking for difficult clays in high-rainfall areas. It is hardy and it stands up well to high winds. Mature trees have not been seen in this country and nothing is known of its timber possibilities, but its product would probably be somewhat similar to that of *goniocalyx*.

Young trees have shown such vigorous growth and such ability to stand exposure that the species is brought forward as a suitable tree to provide quick shade or shelter, either in clays or in free soils. The trees are sparse seeders and seed is difficult to obtain.

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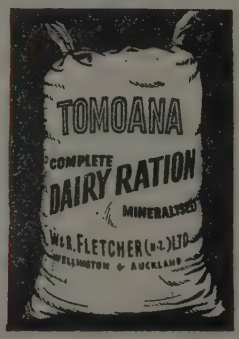

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The clean boles of *E. eugenioides*.

Ornamental Species

Though few have any timber value, the ornamental eucalypts are so attractive and so well suited to the aesthetic improvement of farm surroundings that mention of some of the more easily grown species must be made. Since the flowering varieties arouse most interest, only these are dealt with. Many species have particularly beautiful foliage, many others have arrestingly beautiful boles, and others have symmetrically shade-giving forms. All of these in one way or another lend themselves to the beautification of farm landscapes.

The most popular of the flowering eucalypts is *E. ficifolia*, usually called the red-flowering gum. Its brilliant flowers in all shades of scarlet, borne in clusters at the tips of the branchlets, make it one of the most spectacularly beautiful of all trees. The young plants are extremely frost tender and must be given winter protection during the first 2 years or so. Beyond that stage they are hardier and better able to withstand frost damage. Once established, they can endure frosts of 12 degrees or even more. The tree likes free, well-drained soils and warm situations. It dislikes draughts and cold, waterlogged soils.

E. calophylla is a tree which, in foliage, flower, and fruits is almost the same as *ficifolia*, but it grows much larger. True *ficifolia* seldom exceeds 25 to 30 ft., but *calophylla* can attain a height of 100 ft. or more with a tremendous spread of branches. The pink-flowering form of this tree can be even more spectacular than *ficifolia*. Slightly hardier than its relative, it can be grown in more exposed sites and it will tolerate tighter soils than will the other. It should be planted only where it has room to grow and develop, and away from buildings.

E. leucoxylon has a pink-flowering form which is sometimes called *campbelli* and sometimes *leucoxylon-rosea*. This moderate-sized tree will grow in most soils, but prefers a little dampness. Its chief claim to notice is the fact that it blooms in winter, when any colour is welcome. Its flowers are inconspicuous when compared with the others mentioned above, but they are honey laden and attractive to birds.

As all ornamental eucalypts are propagated from seed, no one can say exactly what the colour of the flowers will be until the tree has bloomed, though the flowers of *ficifolia* are almost invariably some shade of red. Only very rarely are white-flowered forms of the tree seen. In both *calophylla* and *leucoxylon* the proportion of white flowers is very much greater.

Mole Drains for Orchards

THE need for orchard drainage has been known for as many years as fruit has been grown in this country. However, today, though much attention is paid to such things as fertilisers, disease control, and fruit-handling methods, efficient drainage, a basic requirement in successful growing, is frequently neglected. Over the past 7 years officers of the Department of Agriculture have investigated the drainage problem in Auckland orchards planted on heavy clay soils and a number of mole drained orchards have been kept under observation. In this article B. M. Piper, Horticultural Instructor, Department of Agriculture, Tauranga, formerly of Auckland, discusses the importance of effective drainage and how mole drains may be used in orchards.

[*Sparrow*

Fruit trees will not thrive in soil which becomes waterlogged.

RECOGNITION of the existence of a drainage problem is very important. It should not be assumed because trees are planted on sloping ground, or perhaps near a stream some feet below orchard level, that drainage will be satisfactory. Sometimes nutritional deficiencies have been blamed for unthriftiness in trees, where in fact bad drainage or lack of any drainage has been the primary cause.

In the past it was usually the practice to lay tile drains in orchards between 2 ft. and 3 ft. deep, but they have been of little use in clay soils, even when gravel, scoria, or brushwood were placed above the tiles to facilitate entry of water. Where reasons are sought for the unthrifty condition of trees a check first on soil drainage is of major importance.

Effects of Bad Drainage

The most common soil types in which drainage troubles occur are the fine soils where the particles are so small that there is little space between them to allow much movement of water. In orchards the main drainage problem in these soils appears to be where water accumulates in the topsoil overlying an impervious clay subsoil. This is sometimes accentuated on cultivated land where the frequent working of implements at the same depth creates a hard pan which impedes or prevents surplus water from draining away.

During winter after heavy rains the soil may become saturated for prolonged periods and under such conditions the feeding roots of trees cease to function and eventually die. Where the lower feeding roots become waterlogged to such an extent that decay sets in, the trees have to rely on surface roots to supply enough nutrients when spring growth begins.

A further check to the tree under these conditions is often brought about by a dry spring and summer after an unusually wet winter. Often the surface roots (the only feeding roots left) are not able to support normal growth under dry conditions. It is for this reason that in clay soils trees will sometimes die at that time of the year.

Excess soil water and consequently the lack of air in the soil prevent many beneficial bacteria from functioning normally. This in turn prevents chemical changes necessary for tree nutrition from occurring in the soil.

Symptoms of Bad Drainage

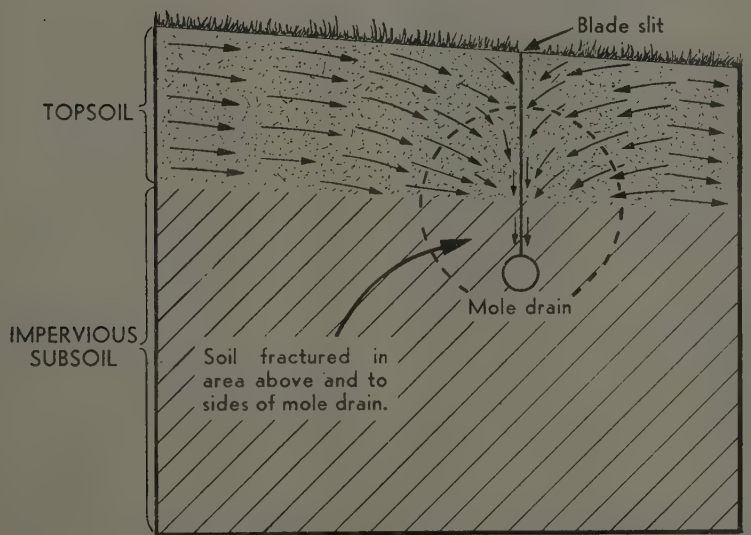
Generally it is not difficult to detect trees suffering from "wet feet", though where symptoms are not severe, unbalanced soil nutrients, deficiencies, or

Light, easily adjusted mole drain plough in position to start the pull from the outlet end of the mole.

The same mole plough as at left in the working position. When the release on the end of the stay at the top of the blade is pulled by the tractor driver the blade swings up out of the ground.

some other soil problem could easily be thought responsible.

Trees having a "stag's head" appearance (stunted growth and small, unhealthy leaves) can often be found in areas known to be poorly drained. The greatest harm caused by excess water is the exclusion of air from the area where the feeding roots of the tree operate, causing the tree to show poor growth and yellowish foliage. Where there is a permanently high water table, root development is confined to a shallow upper layer of soil and the tree becomes susceptible to the effects of summer drought.



Water enters the mole drain mainly through the slit made by the blade, but cracks which are formed above and to the sides of the drain during pulling act as tributaries.

Aims of Drainage

If the source of excess soil water is underground, it is necessary to tap this source and see that the water is drained away unrestricted to some suitable outlet. Generally the origin of excess water is from the surface and is caused by rainfall becoming trapped and prevented from finding its way to a natural outlet. In drainage problems of this kind the aim is to keep the water table low enough to allow normal root development.

Where the structure of the surface soil is poor and the soil tends to compact rapidly during wet weather it can be improved considerably either by cover cropping or by the application of large quantities of organic matter. After this treatment, grassing down the orchard may not only prevent further deterioration but over the years will improve soil structure.

The most common drainage problem occurring in orchards is an accumulation of water that persists over an impervious clay subsoil. Though there are several ways of minimising this

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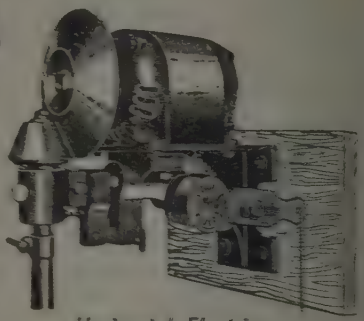

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trouble, one of the simplest and cheapest methods is by mole draining.

Mole Draining

Mole draining is done by pulling a bullet-shaped "torpedo" or plug through the soil, leaving a channel approximately the cross-sectional shape of the plug. The torpedo is attached to the mole plough frame by the blade, which has a sharpened front edge. The blade leaves a slit extending from the surface to the mole channel and this forms the main way for water to enter the drain.

In fact, the mole plough does more than mould a channel and make a drainage slit. Cracks are made in the soil by the action of the plough being pulled through the ground. This pull is accompanied by a lifting action which may extend up to 2 ft. from the slit, depending on the size of mole and the depth at which it is being pulled. The cracks caused by the heaving of the plough do not show immediately in the soil, but after a spell of fine weather they open up and become visible on the surface. This applies especially in orchards that are grassed.

The slits and cracks in the soil caused by the moling are most important for the efficient working of the drain, because it is through these fissures that the surplus soil water finds its way into the mole channel.

It is well known that clay soils shrink considerably on drying and expand again on wetting. Drying and hardening of the cracks take place in summer, but the swelling of the clay during autumn and winter causes the cracks to close again. However, sufficient gap is left in the cracks to allow water to move freely to the drain.

Too deep or excessive cultivation of orchards that have been mole ploughed often restricts the operation of mole drains and sometimes makes them useless. Apart from the risk of cutting shallow moles with heavy discs, the main fault is the destruction of the slits and cracks. For this reason the useful life of mole drains is greater in grassed orchards than in those that are cultivated.

Types of Mole Ploughs

There are several types of mole ploughs, but the general principle is uniform. There must be provision in the making of mole ploughs for adjustment of depth. The method used to allow easy entry of the plough into the ground and for removal must be such that the operation is relatively simple. The skids at the front of the plough should press lightly on the surface of the ground to ensure minimum draught consistent with the plough maintaining an even depth. The thickness of the blade and the size of plug are by far the most important features of the plough.

Thickness of Blade

A 1-in.-thick blade was popular a few years ago, as it was known that the more extensive shattering above the drain allowed a greater flow in the first season into the drain. It was later found that a slit 1 in. wide caused early breakdown of the drain at the point where the slit and channel joined. It is now recommended that a blade no more than a ½ in. thick should be used.

Plug Size

Large plugs are seldom used now, as it is preferable to have a steady flow of water in mole drains rather than the large volume of water that a 4 in. to 6 in. mole could carry. Smaller drains are stronger and, as they carry much less water, will last longer, other conditions being equal.

Plugs used today vary from 1½ in. to 3 in. in diameter. The larger the plug is the wider is the arc of the roof sector and the greater the tendency for pieces of clay to fall from the roof of the channel. A drain pulled with a 2 in. or 2½ in. plug will prove efficient for orchard needs.

Power Required

Many factors influence the amount of power required to pull a mole plough through the ground. The depth at which the mole is to be drawn, the thickness of the blade, the size of the plug, and the manner in which the plough is set up all affect the tractor power required. Much more important are the condition and type of clay being drained. If the soil is drier than it should be, more power is required than if the clay is at the right stage.

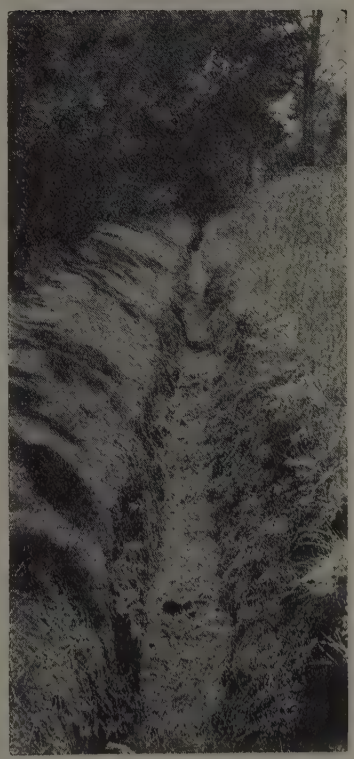
However, as a guide it is known that under average conditions a light mole plough with a ½ in. blade and a 2 in. plug at a depth of 18 in. can be drawn by a tractor of not less than 25 drawbar horsepower. The state of the surface soil will affect the traction. If it is greasy, steel grippers may have to be added to a wheeled tractor, or a tracklaying tractor may be required.

Soil

Not all clay soils are good moling soils. It is desirable that the clay should be free from sandiness, as clay with this property will not set as hard once drying takes place. A check should be made to detect any ironstone or timber in the soil, because when a drain is pulled any such obstacles if struck could spoil a run.

The only reliable way of determining how well a soil will hold mole drains is to test it when moist. A good moling soil should have the consistency of plastic modelling compound. Local knowledge of the soil and any history of mole drains are a big help in deciding whether mole drains should be attempted. The subsoil through which the mole plug is to be drawn should be at least moderately high in clay, and past practical experience in the handling of the particular soil will be most useful.

MOLE DRAINING



[*Sparrow*

Open drains used for mole drain outlets should be kept clear of weed growth and rubbish.

Depth of Moling

It is desirable in orchards to keep mole drains within the 16- to 18-in.-depth range. There is no advantage in their being deeper, as the impervious nature of many subsoils in New Zealand would restrict entry of water to the drain.

Drains can be pulled at depths slightly less than those suggested, but in cultivated orchards there is a risk of damaging the moles or at least of destroying some of the cracks in the clay immediately above the drain.

Length and Distance Apart

Two main factors influence the maximum length of moles for successful drainage. These are firstly the fall available and secondly the nature of the surface. On falls of 1 in 100 or less, moles should not be longer than about 2 chains. With falls of 1 in 80 to 1 in 60 moles can be about 3 to 5 chains, according to the surface; they can be 5 to 15 chains long, again according to the surface, with falls of 1 in 50 or steeper (up to 1 in 15).

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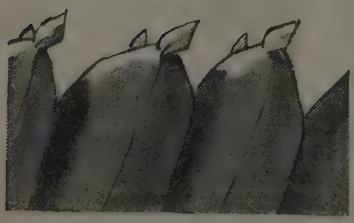

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DAVIES

A fall of 1 ft. in 30 ft. is considered ideal, but areas with less fall can be successfully mole drained. However, the smaller the fall is the more carefully must the surface be levelled. Little trouble can be expected from mole drains with regard to fall if the grade is uniform or increases toward the outlet.

The amount of fall can vary from 1 in 20 to 1 in 100 or less. However, the fall available should be measured.

A moderate flow of water through the drain should be the aim. Either a rush of water (leading to erosion and scouring) through too great a fall or silting (because of too little fall) will seriously affect the life of the system.

Changes of grade downhill decreasing the fall should be avoided because of possible silting, but there should be no trouble if the fall is increased to as much as 1 in 15.

If the surface of the orchard to be moled has to be cultivated in preparation for mole drainage, all such cultivation should be done in the direction it is intended to draw the mole. In this way all ridges formed by the cultivation will run parallel to the mole and will not create uneven surfaces for the mole skids to ride over.

In an existing block of mature trees the orchardist may have little choice of position in which to pull mole drains. It is not possible to over-drain an area with mole drains and the usual difficulty in a block of trees is that not enough moles can be pulled to give a first-class job. However, even if only one mole can be pulled between each row of trees, which is usually the case, this can substantially improve soil drainage.

It is often desirable to place mole drains 6 ft. to 10 ft. apart, but this may be possible only for orchards where new plantings are planned. With large trees at say 18 ft. apart too much damage to roots would be caused by pulling more than one mole between rows. Under some conditions, such as where young trees are planted with wide spacings, it may be practicable to pull two moles spaced 2 ft. or 3 ft. apart midway between tree rows. However, before this is attempted the position of tree roots should be investigated.

Direction of Pull

Opinions vary as to the best direction to pull mole drains. Some experiments have shown that a greater volume of water flows from moles that are pulled uphill than from those pulled downhill. The reason for this appears to be that the cracks created in the soil by the heaving of the mole are made in such a way that they allow easier entry of water to the channel.

However, many efficient drains have been pulled downhill. As long as care is taken with all other aspects of mole draining, the direction of pull will have comparatively little influence on the efficiency or life of the drains.

Outlets

The preparation of outlets for mole drains is very important. In most orchards where there are mole drains, outlets are made into open drains. This method is one of the simplest and one of the most effective.

Water in the moles must be kept flowing and must be allowed to fall away from the outlets without hindrance. If a stoppage is caused, silting up will further slow down the flow and soon block the drain. Open drains should be kept free of heavy weed growth and a periodic inspection should be made to see that the normal winter level of water in the open drain is a few inches below the outlets of the moles.

Mole-tile Junctions

There is no need in orchards for junctions of small moles into larger ones or even into moles of the same diameter. However, where open drains cannot be used as outlets a tile drain must be used.

Where a combined system is being used the tiles should always be laid deep enough to avoid the mole plough striking them. The distance from the mole drain to the top of the tile beneath should be 2 in. to 3 in. Thus, if a 2 in. mole at a depth of 16 in. needs to be joined to a 4 in. tile below, the tile trench should be 25 in. deep.

Ample size in tiles should be allowed for in mole-tile systems. Flows of water are very high from mole drains soon after rain has started falling, and if insufficient size is allowed for in tile outlets, back filling of water into the moles could occur with associated damaging of the channels.

The usual method of joining the mole to the tiles is by thrusting a spear down from the surface to the side of the tile. Scoria or crushed metal is often used alongside and above the tiles to allow the entry of water at the tile joints. The spear is thrust into this metal and water will pass down the spear hole, through the metal, and into the tile. Stones larger than ¾ in. in diameter should not be used, for, if remoling has to be carried out, larger stones above the tile drain can cause the mole plough to rise and give a subsequent loss of fall in the channel.

Time of Moling

It has been found that the ideal time for moling is in late spring and early summer. However, the condition of the soil is the essential thing rather than a particular date. The subsoil must be still moist and reasonably plastic. At the same time the surface must be firm enough to give good traction.

Heavy rain soon after pulling is very undesirable, as it can lead to breakdowns in the channels. New moles are not at their best until drying and hardening of the mole walls has taken place and the cracked soil above has hardened.

Life of Drains

All features of mole drains can influence their working life, and it is not easy to decide which is the most important. Just as a chain breaks at the weakest link, a mole drain works efficiently until the weakest point fails. Usually the cause of failure begins with one of the following:

1. Outlets.
2. Length of each mole.
3. Fall.
4. Soil type.
5. Weather and soil conditions after draining operations.

Depending on the points mentioned, mole drains should last from 6 to 10 years or more. Contours of the area may be too irregular to allow even falls, or the soil type may not be suitable. Light or sandy soils are unsuitable, but moles have been used successfully in peat soils.

Reticulated spray lines or natural obstructions such as ironstone or timber in the soil are sometimes the reasons why mole drains cannot be used. In some areas interplanted orchard blocks would be difficult places for which to plan successful mole drainage schemes. Occasionally the direction of the tree rows may be found unsuitable in relation to the fall of the ground.

Summary

Effective drainage of land used for production is essential. There is ample evidence that carefully planned mole drainage systems operate efficiently and for long periods in clay soils where levels, contours, and other factors are suitable.

Mole draining is the cheapest effective way to drain clay soils, but it has limitations and depends largely on good planning and careful workmanship. A faulty plan or a careless job can make a mole system the least efficient of all methods of drainage. Blocked moles or depressions in mole lines can cause concentration of water at points that create problems greater than the initially poor drainage.

The work must be well planned and executed. A detailed plan of the layout should be kept to facilitate inspections and to enable faults which may develop later to be traced and remedied without delay.

Reference

A. W. Hudson and H. G. Hopewell, Department of Scientific and Industrial Research Bulletin No. 36, "Mole Drainage in New Zealand".

Care of Livestock during May

Contributed by the Animal Research Division

BLOOD POISONING IN HOGGETS

BLOOD poisoning in hoggets grazing on turnips is becoming an increasingly important problem. Deaths occur from infection with the blackleg organism, which probably enters through the mouth. An excellent vaccine, which confers very good immunity, can be bought in New Zealand. On properties which have previously had losses hoggets should be vaccinated at least a fortnight before they are placed on turnips. The nearest veterinarian or Livestock Instructor should be consulted about the method of vaccination.

AUTUMN-SAVED PASTURE

In most districts there is still time to provide good winter grazing by shutting up paddocks and letting them grow during autumn and early winter. Having some pasture cover on paddocks before the first frosts will assist pasture growth during winter. Autumn-saved pasture is invaluable for early-calving cows. It also provides the best insurance against sleepy sickness in ewes. If necessary, feed silage to cows now to enable some paddocks to be shut up. Once the ewes have been tupped they are all the better for being done fairly hard until 3 or 4 weeks before lambing. This also will enable some paddocks to be spelled.

INOCULATION OF DOGS AGAINST DISTEMPER

Distemper in dogs can be prevented in a very high percentage of cases by vaccination. This is best done when the pups are 3 to 4 months old.

UNTHRIFTY CALVES

The best feed for calves is good fresh pasture, and this can be provided by rotating the calves through the cow paddocks. Good hay is necessary to supplement the sappy, young autumn pasture. At the first sign of unthriftiness calves should be drenched with phenothiazine, being given the full dose recommended on the label. Drenching, however, will not be effective unless the calves are properly fed.

PREVENTION OF SUCKING BY CALVES

Sucking of each other by calves is a habit which should be broken as soon as it is detected. The insertion of a bull ring is effective in most cases.

MILKING MACHINE OVERHAUL

As soon as the cows have been dried off arrangements should be made for the milking machine to be overhauled by an expert. Do not install complicated gadgets, but make sure that all parts of the machine are working efficiently. This will not only ensure rapid, trouble-free milking, but is likely to increase production and will help to reduce mastitis.

RED WORMS IN HORSES

Red worms can seriously reduce the efficiency of working horses and are responsible for many deaths in foals. Phenothiazine is a very effective remedy, but is best given under veterinary supervision, as in certain conditions it may prove dangerous. Treatment should be administered before winter.

Crop Production

Seasonal Notes by the Extension Division

THOUGH an increase in the total quantity of wheat produced will be secured very largely as the result of an increased acreage, it is necessary to appreciate that this could be offset to some extent at least by the sowing of unsuitable varieties. These notes give brief summaries of the more important varieties and may help in the selection of varieties suitable for the different wheat-growing districts.

WHEAT VARIETIES

WHEATS vary in their suitability for different conditions. **Cross 7** is a reliable variety under conditions of medium fertility. It stands well and its baking quality is satisfactory. If leaf growth is excessive, it should be fed off in spring to check fungous diseases. **Fife Tuscan** is taller than Cross 7 and later in maturing. It is a suitable variety for light land where more straw is an advantage. **Hilgendorf** is usually lower yielding than Cross 7, but has done well in parts of Marlborough and Mid-Canterbury. It matures early and has good baking quality. **Dreadnought** is a high-yielding wheat on heavy land, but loose chaff makes it unsuitable for direct heading. If windrowing can be done and straw is of value, it is a good variety. Its baking quality is low, but it is suitable for biscuit making. **Tainui** is a spring wheat widely grown in the North Island. It lodges badly under good growing conditions. It matures early. **Gabo** is now becoming available and proving satisfactory for North Island sowings. It is shorter strawed than Tainui and earlier maturing.

Two wheats recently released should be more generally available this season and recommendations are as follows:

Arawa should be used as a replacement for Dreadnought on heavy land; it can be direct headed and yields are comparable to those of Dreadnought. **Aotea** should be used as a replacement for Cross 7, particularly under high-fertility conditions. It yields appreciably higher than Cross 7 and its baking quality is about equal. It shows promise as a spring variety.

—N. L. SHILLITO

* * *

GRADING OF SEED POTATOES

POTATO-HARVESTING methods are often dictated by circumstances. When practicable it is preferable to make two samples, table size and seed size, when picking the crop behind the digger. If the crop is picked up in one sample containing both table and seed, the most satisfactory method of grading is to run the potatoes over the grader, separating and grading the table potatoes without making any attempt to grade the seed, which is graded in a subsequent operation. This method gives a far more satisfactory grading of both table and seed.

The standards for certified seed potatoes are clearly laid down by the Department of Agriculture, whose officers are available to advise growers. The range of seed size in the sample (as determined by weight) is important to allow easy planting with the range of mechanical planters available. Dry rot, damage, and disease standards are also important factors, as these determine the keeping quality of the seed.

STORAGE OF SEED POTATOES

The grower must store his seed potatoes with regard to the facilities available. Whichever method is used, the following points should be borne in mind:

1. Exposure to frost is fatal. Very often this type of damage can never be fully graded out. Adequate cover over the top of stacks under or near trees where there is always sufficient draught will remove any likelihood of frost damage. Potatoes should not be covered with canvas tarpaulins without first being covered with straw.

2. With potatoes stored in sheds ventilation is the main problem. They must have ample fresh air. Poor ventilation results in poor sprouting. Unlike table potatoes, seed potatoes benefit by exposure to light.

3. The sacks of seed should be put out in sheltered places such as are provided by live fences or belts of trees. This will prevent long sprouts from forming, which when removed from some of the newer varieties seriously check and often cause numerous misses.

—N. H. GREAVES

* * *

STORAGE OF TABLE POTATOES

OF farm produce which is stored for any length of time, none deteriorates more quickly than potatoes under unsatisfactory storage conditions. Potatoes are attacked by fungi, insects, and rodents, and conditions favourable to the growth and depredation of these pests must be avoided. Due attention must be paid to light, temperature, moisture, and ventilation. Light penetrating into potatoes stored for cooking causes them to green and results in impaired cooking quality. Whether the potatoes are stored in a pit or in a shed maximum exclusion of light must be aimed at.

All potatoes should be dry when stored, as moisture, with warmth, encourages the spread of fungi. Good ventilation is therefore necessary to give an efficient circulation of air which will keep the temperature of the produce as low as practicable. This can be achieved by drain pipes set into the side of the pit or by leaving alleyways between bags when the produce is shed stored.

Rats and mice are more likely to cause severe damage when the potatoes are bag stored. When these rodents are present every effort should be made to get rid of them by poisoning, trapping, etc. Care should also be taken particularly in the North Island to see that old sacks, rubbish, and in particular old potato shaws do not lie around pits harbouring insects such as the potato moth which can at times cause serious loss.

—J. G. RICHARDS

* * *

APPLICATIONS FOR GOVERNMENT STOCK SEEDS

THE scheme of seed certification operated by the Department of Agriculture for grass, clover, and lucerne seeds is based on the production of seed of pedigree strain. Regular reselections of all strains are made and these maintain a steady supply of nucleus material for multiplication. The nucleus material is multiplied by selected farmers under contract to the Department and the seed produced is termed certified Government Stock seed. Government Stock seed, which is the highest class available commercially, is released annually—subject to crop—by the Department of Agriculture, through mercantile channels to approved farmers for further seed production. Farmers wishing to be considered for an allocation of certified Government Stock seed should request their merchants to make individual application on their behalf for their requirements. All applications received by the Department before 31 May 1958 will receive equal consideration when allocations are being made for the 1958-59 season's sowing. It is expected that seed of the following species will be available for distribution: Perennial ryegrass, Italian ryegrass, short-rotation ryegrass, cocksfoot, timothy, white clover, Montgomery red clover, cowgrass, and lucerne.

—O. G. MOORE

Note the concentration of sheep on paddocks on which hay is fed out for wintering in the system described in the article. Poor paddocks are improved by heavy concentration of stock droppings, but there may be some pugging in wet weather.

Wintering Ewes on Hay

By H. McM. BULL,
Instructor in Agriculture, Department of Agriculture, Auckland

WINTERING his flock on hay over the last 5 years has proved for a Whitford farmer, Mr. C. P. Ford, a safe and profitable alternative to growing uncertain crops on land which pugs badly and where satisfactory grass establishment is slow and difficult. With the adoption of a system of rationed hay and grass, Mr. Ford has, over the last 5 years, steadily improved his carrying capacity on 135 acres from wintering 500 sheep in 1952 to 750 in 1957. The provision of feeders is the key to cultivating that initial taste for hay in an animal noted for its selective and sometimes inexplicable choice of herbage. The sheep nosing round the feeder out of curiosity, boredom, or in search of shade eventually nibble and acquire a liking for a material previously treated with some suspicion.

THE quality of the hay must be first class, ryegrass-white clover for preference. Paspalum hay or hay of inferior quality will be eaten only under conditions bordering on desperation. Young sheep as a whole show little enthusiasm for hay of any sort and require to be set a practical example by older and experienced members of the flock. However, once this prejudice has been overcome the practice of hay feeding has numerous advantages.

Confining sheep to a few paddocks allows feed to get away over the rest of the farm. More stock are carried and under cleaner conditions, due to the binding action of hay. Every sheep is under observation twice a day, in the morning when let out on to grass and again when they are brought back for their ration of hay. Poor paddocks are improved by heavy concentration of stock droppings. Constant handling overcomes the nervousness of younger sheep, especially 2-tooths and Cheviots and Merinos. The quieter sheep in turn, together with the constant work, have a steadying influence on any half-trained dog, usually a source of much irritation at lambing.

There are, of course, some disadvantages. Paddocks become cut up round gateways in wet weather. Foot rot may increase and ground become so pugged that harrowing and oversowing may be necessary. Any weakness in fencing will soon be revealed, especially round holding paddocks. These should be in a central position to enable the unlambed ewes to be moved out on to their daily grass ration, leaving behind the newly born lambs with their mothers to be quietly shifted to an adjacent paddock saved for the purpose. This shedding routine is carried right through until lambing is over: 2-tooths are drafted off the main flock and have paddocks and hay to themselves to ensure special care throughout their lambing problems.

Seasonal growth dictates the necessity of feeding hay, which is cut on the property, and provision is made for at least 1 bale per sheep. In a normal season feeding out takes place from about 1 June to 1 September, with a daily ration of 1 bale to every 100 sheep and a run-off of 2½ to 3 hours on saved grass. More hay may be eaten in rough weather, when it should be placed in the feeders and not on the ground, as sheep will not eat wet hay. These feeders hold 2 bales and have the following dimensions: length 10 ft., height 2 ft. 6 in., width 2 ft. at top, narrowing down to 15 in. Sheep netting is tacked along each side and the overhanging top diverts rain that would otherwise soak down into the hay.

A point of special interest is the sward change that has taken place over the years due to the build-up in fertility through heavy stocking. From a predominantly sodbound paspalum turf it is being steadily converted to ryegrass-white clover with little paspalum to be seen in winter.

Hot Water in the Cowshed

Importance of Temperature in Cleaning Milking Machines

By M. J. McFETRIDGE, Superintendent of Farm Dairy Instruction, Department of Agriculture, Hamilton, and W. G. WHITTLESTONE, formerly Senior Principal Scientific Officer, Department of Agriculture's Ruakura Animal Research Station

THE two essentials for the efficient cleaning of the milking machine are a good detergent and boiling water. This article describes the results of a recent survey to discover what detergents are used by the average farmer and how hot is the water he uses for cleaning his machine. It is not difficult to find out what detergent is used, but it is not easy to discover how hot the water is.

SOME recent work at Ruakura has shown that water temperature can be estimated by using "stickers" made by covering the surface of strips of paper with three varieties of heat-sensitive crayons so that the paper will show colour changes at the temperatures of 149, 167, and 212 degrees F. The strips of paper are held on to the milking machine by adhesive plaster.

If the temperature of the surface on which the sticker is placed reaches 212 degrees F., all of the colours will change and the result is regarded as +++. If the water temperature exceeds 167 degrees but is below 212 degrees, two colours change and the result is ++. When the temperature is above 149 degrees but below 167 degrees the result is +, and if the temperature does not reach 149 degrees, no colour change is given and the result is entirely negative.

Method of Checking Water Heat

Four stickers were attached to each machine in the test. No. 1 was put on the tap of the water heater, No. 2 on the far end of the milk line, No. 3 on the middle of the milk line, and No. 4 where the milk line enters the releaser. Usually the stickers were left on for 1 or 2 days and then read. The results represent, of course, the maximum temperatures reached while the stickers were on the machine. This method is much more reliable than using the thermometer, because it actually measures the temperature to which the milk pipe of the machine is raised, and this gives a direct indication of the effectiveness of the hot-water rinse for sterilising the plant.

Types of Detergents

During the survey information was collected on the types of detergents used. This is useful information because it makes it possible to assess the extent to which farmers have availed themselves of the improved detergent formulations now available.

Table 1 sets out the percentage of farmers in the survey using the different types of detergent.

Table 1—Percentage of Farmers Using Different Types of Detergents

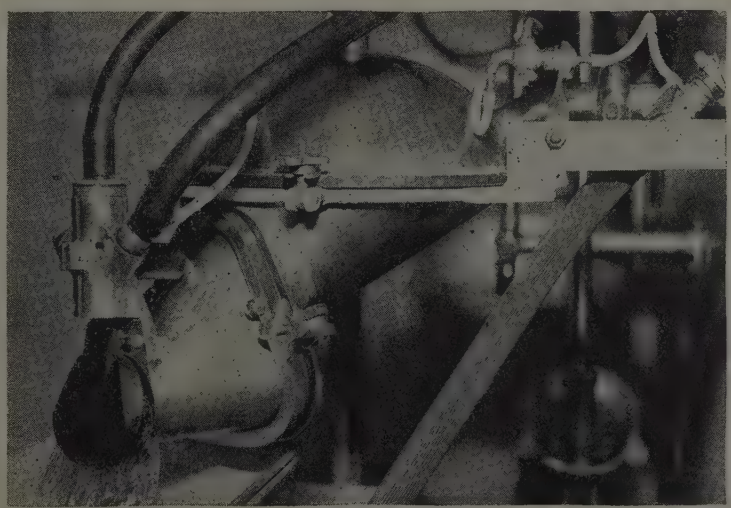
	Per cent.
A detergent complying with the Ruakura formula ..	53.2
Caustic soda	37.5
Simple wetting agent ..	1.4
Wetting agent plus caustic soda	4.9
Ruakura detergent with caustic soda	2.8
Number in survey .. 141	

It is evident that there has been a change toward the use of the improved type of detergent. As a result there appears to have been a decrease in the amount of milkstone in the average milking machine. This is particularly true when the Ruakura system of using acid and alkali is used.

Water Temperatures

Table 2 sets out a classification of farmers into three groups. Group 1 represents those who showed +++ recorded at the water heater and at all points on the milk pipe. This means that a temperature of 212 degrees F. (boiling point) was reached in the milk pipe of the machine during cleaning. Included in this group are those who showed a +++ reading for the water heater temperature and ++ readings on the milk pipe. In this case the water is boiling in the heater and is between 167 and 212 degrees F. in the milk pipe, which represents a satisfactory level.

This first category can be regarded as satisfactory for water temperature in that rinsing water in this temperature range would keep the machine in a good condition bacteriologically. The second group show boiling water temperatures for the water heater, but lower than 167 degrees F. for at least one of the stickers on the milk pipe. Quite a high proportion of farmers had boiling water but no temperature change whatever on the milk pipe. These are included in this second group. The third group are those



With a recycle unit the water is circulated through the releaser as shown here and is drawn back into the machine by the hose attachment. The upper tap draws cold water direct from the main.

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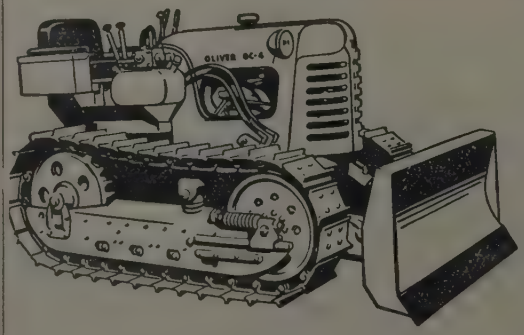

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whose water heaters did not reach boiling point. Needless to say they showed a very unsatisfactory temperature on the machine.

Table 2—Percentage of Farmers Using Water of Different Temperatures

In group 1 +++ +++ +++ +++ +++ or +++ ++ ++ ++	8.6
With boiling water but temperatures less than 167 degrees F. in the machine	18.0
Without boiling water	73.4

The results set out in Table 2 are far from satisfactory. Only 8.6 per cent. of the farmers in the survey had boiling water and used it properly. This is a very poor performance.

The fact that 18 per cent. of the farmers had boiling water but used it in such a way that the water temperature in the machine did not reach 167 degrees F. indicates that a high proportion of farmers do not know how to use hot water properly. Apparently the rate at which hot water cools off once it is placed in a bucket is not fully appreciated. It is obviously wasteful to boil the contents of a water heater and then draw the water off and let it stand in the buckets for some time before using it.

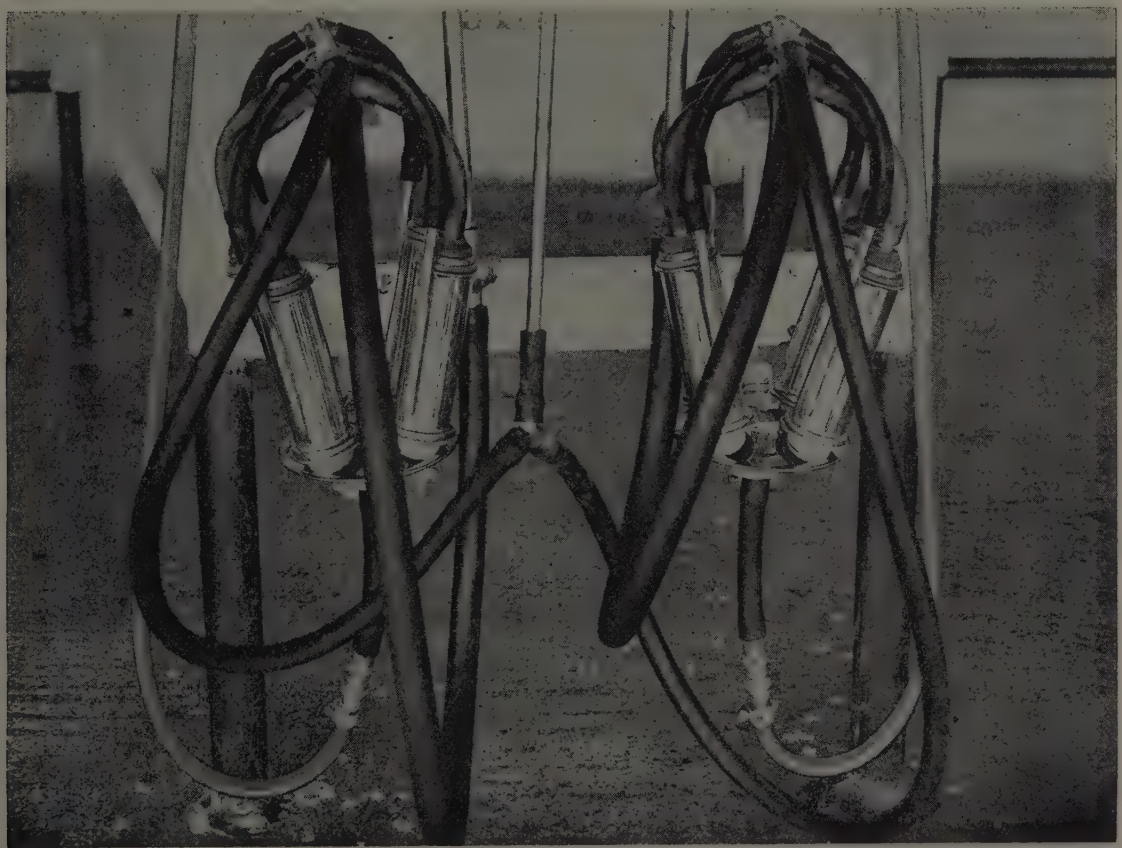
A practice which is not uncommon on dairy farms is for the farmer to pour the hot water into buckets just before he starts the cleaning process. This means that while the cold-water flush is being put through the hot-water temperature is falling. Obviously the water should go as quickly as possible from the heater to the machine.

The very high percentage of farmers (73.4 per cent.) who did not have boiling water indicates that if there is to be any marked improvement in the quality of dairy products, there must be a stepping up in the efficiency of the water heaters.

The recommended method of cleaning at present is the use of an alkaline detergent 6 days a week at every milking with acid detergent used 1 day a week. After the hot detergent solution has been used the machine should be sterilised with boiling water. In this system the cleaning is done by the detergent and the sterilising by the hot water. Good cleaning is essential and the fact that over 50 per cent. of the farmers in the survey used an improved detergent indicates that farmers are becoming aware of this, but too little emphasis is being placed on the importance of hot water for sterilising the machine.

Best Use of Hot Water

The following suggestions are made as a means of getting full use from the hot water which is available on about 27 per cent. of farms. Immediately after milking the machine should be rinsed with plenty of cold water. Two gallons of cold water per set of cups with double this quantity for the last set of cups is recommended. Plenty of cold water removes milk



▼ A recycle unit with the teat cups over the spray nozzles. The union between the plastic hose and the rubber hose is fitted with a special attachment which provides running water in the bail for udder washing when the recycle unit is not in use during milking.

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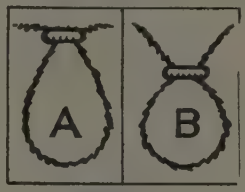

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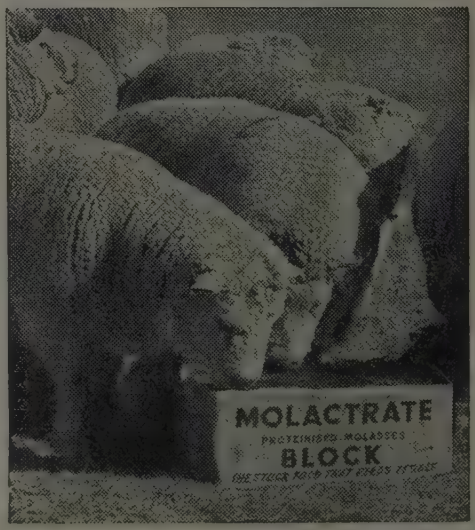

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A recycle unit, showing the distribution of water when the cups are not in position.

residues and the work of the detergent is greatly reduced.

The hot detergent solution should not be made up until just before it is used, when it should be carried straight into the bails immediately after mixing and the plant flushed immediately. It is even more important that no time be wasted between the running off of the boiling water for the final rinse and its application to the machine. This rinse should if possible be put into buckets which have already been heated by the hot detergent solution, thus saving heat.

When circulation cleaning is used the cold-water rinse should be run into the machine straight from the cold tap. This will increase the rate at which the cold water passes into the plant and will save the farmer time. It will also help to ensure that an adequate amount of cold water is used. With this rinsing technique the water should flow through the machine until it emerges from the releaser completely free from any trace of milk.

One effective method for maintaining the temperature of the detergent rinse is to draw hot water in straight from the hot-water heater. This may be easily done by allowing the water to flow into a bucket in which the circulation inlet pipe is placed and which contains the appropriate amount of detergent. The detergent will dissolve as the hot water flows into the bucket and out again.

The total amount of solution run into the machine may be estimated by allowing it to run from the releaser into a bucket of known capacity until the right amount has accumulated. The intake pipe is then transferred to the bucket at the releaser and circulation carried on without the addition of further water. With this method the first solution running into the machine will have a high detergent concentration, but this does not matter, as it will become mixed up uniformly during the circulation process.

Finally the last rinse should be drawn straight from the water heater. This can perhaps be most effectively done by connecting the intake straight on to the hot-water tap, the total volume again being estimated from the amount which comes from the releaser into a bucket or can. The farmer can quickly estimate the amount of water held in the machine before it emerges from the releaser by running water from a known quantity of water into the machine until flow at the releaser starts and noting the amount which has gone in.

The two most important points which have emerged from this survey are:

1. About 20 per cent. of farmers have boiling water and waste it. This indicates the need for a common-sense approach to the use of the hot water available.
2. Almost three-quarters of the farmers in the survey had no boiling water, a most unsatisfactory state of affairs which can be overcome only by the use of more efficient water heaters.

CONTROL OF BARBERRY

OVER the last few years barberry (*Berberis vulgaris*) spread from hedges has become a weed on the rolling and hilly country of the Whakatane and Opotiki districts. Generally it grows in association with scrub on the slopes and in the gullies, though it is also common on more open country. Here it has persisted, as it is resistant to the normal methods of control, such as cutting and burning, and it is unpalatable to stock, even in the young stages of growth.

FIELD trials carried out in the Whakatane district have shown that barberry can be effectively controlled with some of the common weedkillers.

CONTROL OF SEEDLINGS

YOUNG seedling plants are killed by an overall application of 2,4,5-T and water plus about 5 per cent. of diesel fuel oil. Because the action of the 2,4,5-T is largely by contact, complete foliage cover is essential. The spray should be atomised as much as possible, as coarse spray will not adhere to the small leaf area. A dilution rate of 1 part 2,4,5-T to 100 parts of water to 10 parts of diesel fuel oil is a satisfactory mix for spot application.

CONTROL OF MATURE PLANTS

For most heavily infested areas the most practical method is to use 2,4,5-T oil concentrate as a basal application. The control of mature barberry with an overall application is not satisfactory. The 2,4,5-T oil concentrate is further diluted with diesel fuel oil in the ratio of 1 to 40 and is applied from ground level up to a point about half way up the plant. The spray must completely encircle the bush on living wood, as any limbs not sprayed will continue to grow. For basal application diesel fuel oil or other aromatic carriers must be used. Water is not satisfactory, as little or no penetration occurs and the 2,4,5-T oil concentrate will not mix with water.

An alternative method is to apply the above mixtures of 2,4,5-T oil concentrate and diesel fuel oil to the freshly cut surface of barberry stumps. This method is suitable for application to mature isolated bushes of barberry. For good results the application must be made immediately the bush is severed from the stump. This method is quite effective for barberry at any stage of growth. It is very economical in the use of materials, but entails much labour in the cutting back of the bush and disposing of top growth, which, if not destroyed, is good cover for further weed invasion.

Non-selective chemicals used at soil-sterilisation rates are also satisfactory. "Atlacide" applied dry at ½ lb. per plant around the base of growing plants has given good results, but results from application of this material to cut stumps have been poor. "Atlacide" should be spread evenly round the bases of plants. Used in the same way monuron at 8 gm. (about ¼ oz.) per plant is also effective. Monuron can be applied with water or more readily by mixing with lime.

The most satisfactory control of regrowths 18 in. or more high from cut stumps is by the use of monuron or "Atlacide". These treatments can also be used satisfactorily for the control of isolated plants, but are too costly for large-scale use. Both chemicals have disadvantages. The area must not be stocked if "Atlacide" is used, because stock tend to lick the area treated. Monuron also tends to wash laterally, killing desirable vegetation for a considerable period.

TIME OF APPLICATION

Time of application is not important when 2,4,5-T oil concentrate is applied as a basal application. Probably the best results are obtained just at the start of spring growth. Plants treated at this time of the year usually die during the following summer. If treated later in the growing season, trees usually take a full year to die.

The soil sterilants monuron and "Atlacide" must be applied when there is likelihood of subsequent rainfall. Both the chemicals require to be washed into the soil by rain before becoming effective. Early spring is probably the best time to apply these chemicals.

SUMMARY

Barberry is not easy to kill. It can be killed by applying 2,4,5-T oil concentrate and diesel fuel oil as a basal application. All growth stages of barberry are killed by this method except regrowths from cut stumps. These plants are best controlled by "Atlacide" or monuron used at soil-sterilisation rates.

—S. R. HEWITT

Footnote: Experimental work carried out by Instructors in Agriculture in the Taumarunui, Wanganui, and Banks Peninsula areas has also shown that effective control of barberry can be secured with 2,4,5-T oil concentrate applied either to the surface of freshly cut stumps or as a basal application to mature plants. Hawthorn can be controlled in a similar manner.

Seed Production in New Zealand

Cowgrass

By J. P. BEGGS,

Instructor in Agriculture,

Department of Agriculture,

Blenheim

COWGRASS (*Trifolium pratense*), or broad red clover as it is sometimes called, has played an important part in New Zealand farming from the early days, and for 80 years or more it has been extensively used as one of the country's main clovers. Harvesting of seed from this clover has been popular in some localities for many years, and New Zealand cowgrass seed has earned a high reputation overseas for its consistently good quality. This article describes methods of seed production throughout New Zealand. Practices vary in different districts, depending on climate.

THOUGH cowgrass is used extensively as an ingredient of temporary pastures throughout New Zealand, in the past seed production has been concentrated in a relatively few districts. Some areas, notably certain localities in Marlborough and Nelson, have proved eminently suitable for seed production, and it is in the former province that the great bulk of the seed has been harvested, with Nelson becoming increasingly prominent and, more recently, Canterbury.

▲ Cowgrass at the correct stage for shutting up for a seed crop.

▼ Cowgrass in flower.

Description of Plant

Cowgrass is a vigorous-growing, short-lived plant which produces a large bulk of feed for 2 or 3 years. The useful life of a stand seldom exceeds 3 years and quite frequently areas are ploughed after the second year.

The plant has two main virtues. Firstly, it grows rapidly in spring and produces a large bulk of palatable and nutritious fodder at this time. This growth is normally used for hay, the quality of this product being high. Secondly, it produces a rapid aftermath of growth after the hay cut and continues growing through the dry, summer months, this growth culminating in a valuable seed crop when the area is not grazed.

This good summer production in spite of dry weather is due to the clover developing a long taproot which penetrates even the stiffest subsoil in search of moisture. It is, therefore, under very dry soil conditions only that cowgrass dries off in summer.

On heavy land under favourable conditions cowgrass plants grow very rank and sometimes the stems of individual plants grow to 3 ft. or more. The flowers are normally a deep pink, though colour is a variable factor. Sometimes almost-white flowers are seen on odd plants.

Comparison with Montgomery Red Clover

Montgomery red clover is a similar clover and may easily be confused with cowgrass. However, Montgomery red clover has a lower-set and more densely growing crown than has cowgrass, and the later spring growth of

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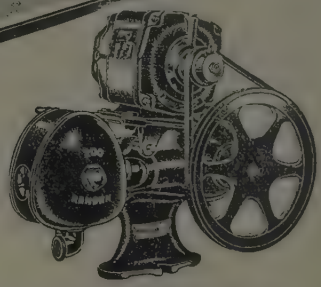

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the former usually results in no hay cut being secured before a stand is closed for seed.

It is widely recognised, too, that cowgrass is a heavier seed producer than Montgomery red clover, and this factor, with the double return (hay and seed) secured from cowgrass, makes it a profitable crop to grow in districts where good seed yields are obtained.

Briefly, it may be stated that cowgrass is the earlier-growing, short-lived, temporary-pasture type of red clover, whereas Montgomery red clover is the later-growing, long-lived permanent-pasture type suitable for grazing. Cowgrass cannot withstand continued heavy grazing.

The clover huller is still used occasionally to thresh cowgrass seed.

Soil and Climate

Cowgrass is very adaptable, for it has been grown successfully under almost all New Zealand soil and climatic conditions, and it has an important place in farming in both the high- and low-rainfall districts. Excellent stands are found on soils varying from friable loams and silts to stiff clays. However, though cowgrass has wide adaptability in regard to soil type, and though some excellent seed yields have been obtained from a wide variety of soils, the most consistent returns are secured from clay loams, possibly because of the better moisture-retaining properties of these soils. As the cowgrass seed is harvested in autumn, either a reliable summer rainfall or a heavy soil type is essential to the production of consistently good seed crops. Further, a reasonably settled autumn climate is necessary for harvesting operations.

Location

More important than soil and climate in the production of seed from this crop, however, is location, for though many districts grow excellent stands, only few produce consistently good seed crops.

Mainly important in the location factor is the bumble-bee population. Good fertilisation and seed setting appear to depend mainly on the activity of bumble-bees in the crop, and no matter how prolific the flower heads may be, the yield of seed will be poor unless a high percentage of the flowers are fertilised.

Certain parts of Marlborough and Nelson, notably the valleys near Kaituna, Okaramio, Havelock, Canvastown, Mahakipawa, and other districts where conditions are favourable for vigorous bumble-bee activity, consistently produce high-yielding seed crops. It appears that bumble-bees secure better nesting conditions in hilly country than on extensive plains, with the result that the bee population is greater in hilly country.

The small valleys, closely shut in by high hills, possess a further advantage in providing hot, sheltered conditions favourable to the activity of bumble-bees.

The crosses indicate the areas where cowgrass seed is produced.

Place in Rotation

Different rotations used for cowgrass are too numerous and varied to be given in detail, and it is emphasised that a great variety of rotations, to meet local conditions and requirements, may be successful. In all cases it is, of course, essential that sound crop-rotation principles be adopted.

In some cowgrass seed-producing districts very little cropping is done and in such cases there is little scope for

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variety in crop rotation. However, it is well recognised that results from seed production are best after land has had a spell from this crop. In cropping areas this spell is secured by growing cash crops for several years after the cowgrass has weakened and before resowing, and in non-cropping localities a period in permanent pasture with white clover serves to provide the spell from cowgrass.

In the most successful cowgrass seed-production area in New Zealand, the Kaituna Valley, there is little cropping, and the most successful rotation in this locality appears to be that with rape, pasture, and cowgrass. The run-out cowgrass is ploughed and ordinary pasture with white clover is laid down for a few years. The white clover is then ploughed and the cowgrass and rape are sown together. The young clover withstands the grazing quite satisfactorily during the feeding of the rape and comes away for a good seed crop in the following season.

In areas such as the Canterbury Plains, where cowgrass does not produce such outstanding returns as in the Kaituna Valley, a common practice is to sow in autumn after a fallow with short-rotation ryegrass or Italian ryegrass with the object of securing seed from the ryegrass in the first harvest and from the cowgrass thereafter until the area is ploughed. With early-autumn sowing much useful grazing is obtained from the ryegrass during the first winter. Such sowing may be successful with a rotation such as pasture or cowgrass—peas—wheat—green feed—ryegrass and cowgrass.

Another common method of establishing cowgrass is under cover of a cereal crop. Provided the cereal does not lodge and act as a "smother" instead of a "cover" crop, this method can give very satisfactory results, for there is a good cash return from the cereal while the clover is establishing. A typical and satisfactory rotation when sowing in this way would be pasture or cowgrass—peas—wheat—oats or barley (oversown with cowgrass). On light land the second cereal crop would be omitted and the cowgrass sown in spring under cover of the first cereal crop. Sometimes on good land successful crops of both oats and cowgrass are secured in the one harvest season, particularly when the oats are cut early for chaff. However, this practice is far from general.

Cowgrass (background) and Montgomery red clover (foreground), showing the earlier spring growth of the cowgrass.

These few examples merely indicate some of the common and satisfactory rotations and it is obvious that many other suitable ones could be used to fit in with local conditions and requirements. It is emphasised, however, that farming practices must be sound. Suitable crops to clean the land should be incorporated in the rotation. Cereal crops are ideally suited to incorporation in a cowgrass rotation, as they not only clean the land, but at the same time "cash in" on the fertility which is built up after several years of vigorous clover growth.

Preparation of Seedbed

In common with all small seeds cowgrass requires a well worked and consolidated seedbed for rapid and even establishment. This means that ploughing should be done well ahead of the scheduled sowing date, and if time and weather are allowed to influence the consolidating and mellowing of the soil, results will be better than when seedbed preparation is hurried by mechanical means.

It is important, too, that the land should be clean, and time spent in destroying weeds is far from wasted. The summer fallow is always a powerful influence in promoting good establishment and growth of all crops, and when serious weeds such as couch are in the seedbed the fallow with frequent cultivation is absolutely essential to good results.

Lime Before Sowing

Good cowgrass seed crops normally require liming and generally it is most satisfactory to apply the lime to the seedbed before sowing. If applied and lightly harrowed in before the seed is sown, the lime can exert its beneficial effect much earlier than when applied as a topdressing after the crop is established.

It is usually wasteful to apply small quantities of lime, and unless the lime content of the area is known to be high it is sound practice to apply a dressing of 1 ton of lime per acre to the seedbed. On very acid land an initial application of 2 tons per acre may be required. Every endeavour should be made to encourage rapid establishment of the clover, for a good start is all-important to the future welfare and productivity of a cowgrass stand. Slow establishment or a patchy strike allows weed invasion and resultant loss in production.

Time and Method of Sowing

Cowgrass may be sown successfully in either spring or autumn, depending on the local soil and climate and the method of sowing. In parts of Marlborough, for example, considerable spring sowing with rape is done. This suits the local requirements quite well, for the districts concerned receive a reasonable summer rainfall and there is therefore little risk of summer droughts affecting the establishment of the young plants.

In these parts, too, the cowgrass seed crop is very payable indeed, and therefore every endeavour is made to get a good seed crop as soon as possible. If sown in spring with rape, plants become strongly established during the first summer and autumn and a good seed crop is assured in the following harvest season. Normal grazing of the rape appears to have little detrimental effect on the young clover plants, and provided the stand is not "punished" at this time, the clover plants benefit from the surface fertility resulting from grazing of the rape. In this connection it should be remembered that grazing rape in breaks and closing each break to stock immediately grazing is completed are less damaging to the young clover than when stock are allowed to graze and trample the area for a longer period.

Different seeding rates are used by different farmers, the quantity sown varying between 5 lb. and 10 lb. per acre. Some growers add no grass seed, but it is usual for a low seeding of either Italian ryegrass or perennial ryegrass (5 lb. to 10 lb. per acre) to be

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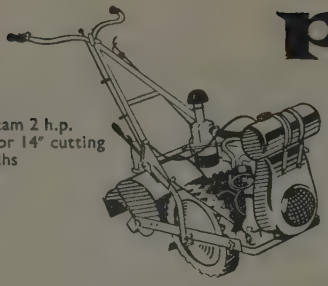

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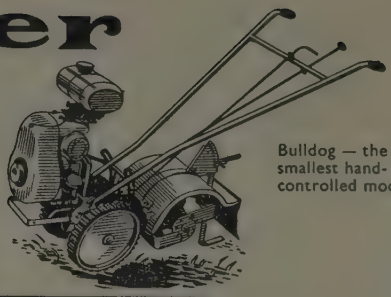

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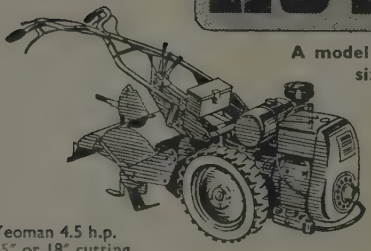

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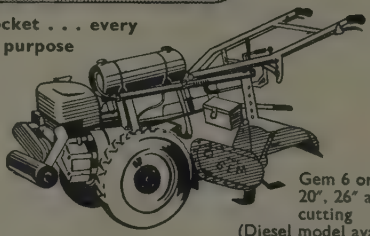

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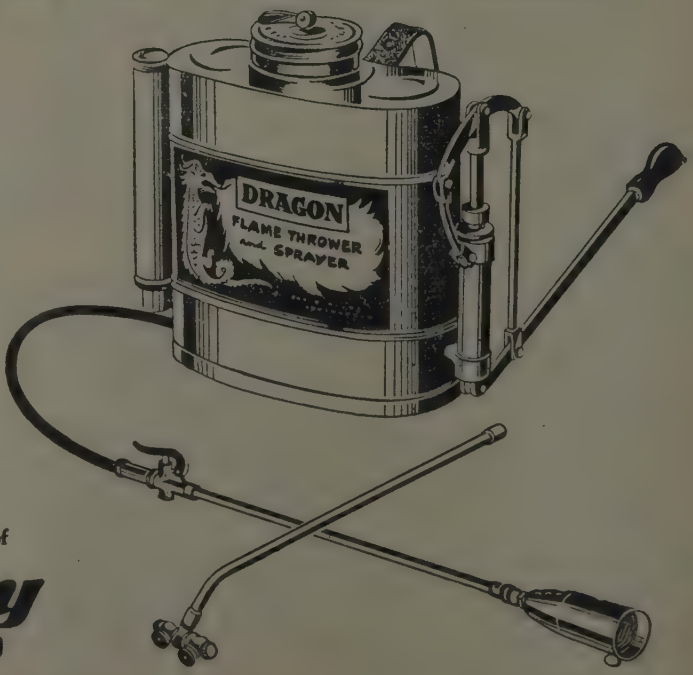

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sown with the cowgrass. Occasionally the quantity of perennial ryegrass sown rises as high as 20 lb. or even 30 lb. per acre.

When sown with a cereal crop the clover is normally sown without any grass seed. If the clover is sown at the same time as the cereal, whether in autumn or spring, the latter is drilled first and then the clover is either drilled or broadcast after the seedbed has been rolled.

If the cereal is autumn sown and the clover sown under cover of it in spring, a seedbed is prepared with a roller or harrows or both. The seed is then broadcast and harrowed in. This work is done in August or September and must obviously be done before the cereal has produced too much growth.

For autumn sowing with Italian ryegrass or short-rotation ryegrass early sowing is desirable and the best way of ensuring that conditions will be suitable for early sowing is to summer fallow the area. Under these conditions 5 lb. to 6 lb. of cowgrass seed and 20 lb. of ryegrass seed per acre are sufficient. Drilling is preferable on dry land, though broadcasting is satisfactory on good moist land or in higher-rainfall areas.

Manuring at Sowing

It is normal and sound procedure to sow phosphate with the seed. At least 1 cwt. per acre should be used, but this is sometimes increased to 1½ cwt. or 2 cwt. per acre, depending on conditions. Superphosphate is the standard fertiliser used. Sometimes reverted superphosphate or a farm mixture of lime and superphosphate is used, and molybdenum is beneficial under some conditions.

Liming Established Stands

Frequently, cowgrass seed areas are left down for two seasons only, and if heavy liming is done at sowing, no further application is necessary. If the areas are left down for a longer period, additional lime will probably be necessary, depending on the soil and climate.

As lime acts slowly when topdressed on to a pasture, liming of cowgrass stands should be done in autumn or early winter. This allows time for the lime to penetrate the soil and exert its beneficial effect in spring and summer. Lime applied in late spring or early summer cannot be expected to have any appreciable effect on the seed crop immediately following.

It is impossible to recommend standard quantities of lime, as this will depend on the requirement of the soil. However, on land that is known to be deficient in lime at least 1 ton per acre should be applied.

Manuring Established Stands

Most New Zealand soils are deficient in phosphate, and marked benefits are usually secured from superphosphate topdressings. The cowgrass seed crop is no exception, and it is common to apply a dressing of superphosphate each year to areas to be closed for seed. Frequently 1 cwt. to 2 cwt. per acre of this manure is applied after the hay is taken.

Cowgrass in the swath before it is picked up by the header harvester.

However, it is felt that better results are obtained by earlier application. Manure applied after the hay is taken will certainly give a boost to the crop if rainfall conditions are favourable, but if a dry period follows the application of fertiliser, no benefit will be secured until moisture conditions are suitable for taking the manure down to the plant roots. Again, fertiliser applied toward the end of November can give little aid to the development of strong, vigorous plants, whereas early topdressing will stimulate strong root systems which will stand the plants in good stead if the weather turns unfavourable later.

For this reason early spring topdressing at the time of closing for hay or shortly afterward is recommended. Perhaps the ideal system would be to apply a light dressing of superphosphate with the lime in autumn and another light application of the fertilisers in spring. The possibility of sulphur and molybdenum deficiency should be considered.

The autumn dressing encourages good root development and good plant growth generally through winter and spring, and the later application stimulates growth for the seed crop.

Grazing

Some farmers in the high-producing seed areas carry out practically no grazing. If the clover is sown with rape, for example, the rape is grazed twice, but thereafter the stand is treated as a hay and seed crop.

Other growers in the same districts, however, believe that grazing is both permissible and desirable in the second and third years. The important

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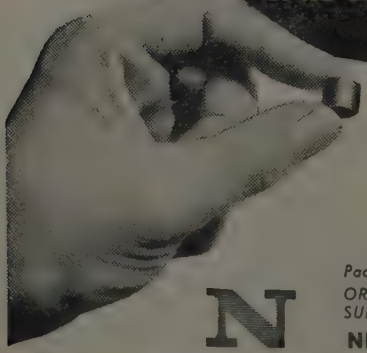

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A header harvester at work in a cowgrass seed crop.

factor seems to be the nature of the grazing, for light, controlled grazing does not harm the stand.

When the cowgrass is sown early in autumn with Italian ryegrass or short-rotation ryegrass considerable grazing may be secured during the first winter without harming the cowgrass, for the latter does not show up much until after the hay or grass-seed crop has been taken.

No hard-and-fast rules can therefore be laid down about grazing. Cowgrass certainly cannot withstand hard grazing, but if light, controlled grazing is adopted, some valuable feeding may be obtained from seed areas at little or no cost to the life of the stand.

The Hay Cut

Cowgrass areas are normally cut for hay before they are closed for seed. This is usually done in the second half of November or during the first fortnight in December. In Marlborough cutting is normally completed before the end of November, but further south the hay cut is frequently not ready until December. After the hay crop is taken the area is left closed to stock until the seed is harvested in late autumn.

Owing to the early growth of cowgrass in spring a good, heavy crop of hay is usually secured. An average yield of hay would be about 35 cwt. per acre. Of course, yields vary considerably from year to year as well as from district to district. Sometimes as much as 3 tons per acre is obtained in areas of high fertility with favourable weather, but on the other hand yields on lighter soils often fall below 35 cwt. per acre.

Pollination

A most important factor in cowgrass seed production is pollination. Often stands presenting an excellent appearance with abundant flower heads produce very disappointing yields of seed. This is usually due to unsatisfactory fertilisation.

The main agent in the fertilisation of cowgrass is the bumble-bee, and if this bee, particularly the long-tongued species, is abundant in the crop at flowering time, good fertilisation is assured. As mentioned earlier, location has much to do with bumble-bee population, but other factors such as shelter and sunshine are also important, for all bees work best in warm, sheltered situations. Another important factor is the time of closing the area for seed. Normally it is relatively late in the season before bumble-bees appear in any great numbers, and areas that are closed for seed early are usually found to be poorly "filled" at harvest time.

Before the introduction of bumble-bees into New Zealand in 1885 seed yields were very poor and complete failures were not uncommon. Honey-bees, especially the long-tongued (Italian) type, can also fertilise cowgrass, but they are not nearly as efficient as are bumble-bees. Honey-bees prefer white clover to red clover, but if these bees are present in large numbers in a cowgrass crop, they probably effect some fertilisation.

A survey carried out by the Department of Scientific and Industrial Research several years ago disclosed

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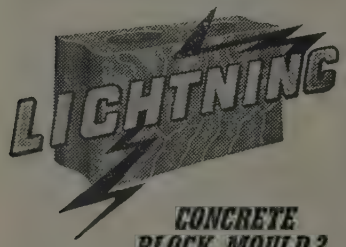

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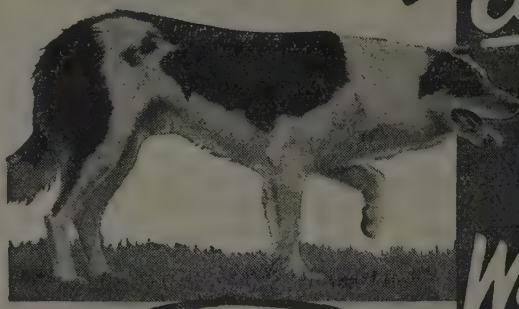

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that there are three main species of bumble-bee in New Zealand. These are *Bombus terrestris*, *Bombus ruderatus*, and *Bombus subterraneus*, the two first-named species forming the bulk of the total population. Of these two commoner species *Bombus terrestris* is short tongued and *Bombus ruderatus* long tongued.

In the survey it was discovered that the long tongued bee (*Bombus ruderatus*) accounted for almost 80 per cent. of the total bumble-bee population working in red clover crops in Nelson and Marlborough, and *Bombus terrestris* composed over 60 per cent. of the population in Canterbury. This fact and the much lower bumble-bee population in Canterbury probably largely explain the greatly superior seed crops obtained in the Nelson-Marlborough areas.

Harvesting Methods

Cowgrass normally ripens fairly unevenly and it is impossible to secure all the seed heads at the ideal stage for harvesting at any one time. For this reason samples of seed contain a proportion of greenish seeds mixed with the more mature, reddish-purple ones. A line of seed is said to possess good colour when the proportion of dark seed is high.

Owing to this uneven ripening habit the crop is usually cut with the mower and allowed to ripen further in the swath before threshing, though direct heading is also done. In the former method cutting is done with the ordinary mower, sometimes with an inside divider attached to leave the material in a suitable state for picking up with the header.

In suitable weather the time allowed between cutting and threshing is usually from 10 days to 2 weeks, but as most of the harvesting is done during March and April, unfavourable weather frequently prolongs this period. Sometimes the cut material is lifted by forks or by machine to aid drying. Occasionally recutting under the swath is necessary if there is much regrowth.

Direct heading is frequently used, more especially for light seed crops which have ripened fairly evenly on light land in areas of fairly low rainfall. In some areas, too, where cutting is considered rather risky on account of strong winds, direct heading is often chosen as the harvesting method.

It is not practicable to give details of exact settings of header harvesters for threshing cowgrass, as these vary with the type of header. Much more important, however, is an appreciation by the operator of satisfactory harvesting conditions. If the recommended adjustment for a particular type of header is adhered to and the crop is fit to thresh, there will be little difficulty. Too often, however, threshing is begun too soon in an endeavour to get the seed "safely in the bag" at the earliest possible time. Though this is a commendable outlook, the "hurry-up" attitude is often carried too far. Threshing when the material is not fit may result in considerable loss of seed or in devaluation of the line because of damage to the seed.

When a farmer has his own header harvester he will use it for threshing. Frequently, however, the clover huller is used, sweeps being used to convey the material to this machine. Quite often, too, the clover is stacked to store it safely while waiting for the huller. Stacking is also standard practice in localities where the climate prevents satisfactory conditioning of the material in the field.

Removal of Rubbish from Paddock

After the header harvester has been used large quantities of straw are frequently left on the paddock, and sometimes this is not cleared from the area after harvest. However, unless the straw residue is very small it is a wise plan to dispose of this rubbish, for, if it is left lying in strips, it will smother the covered clover plants and provide cover for the grass-grub (*Costelytra zealandica*) and porina (*Oxycanus*).

Machine Dressing

Lucerne, burr clover, striated clover, and medium-sized ribgrass seeds are very difficult, and sometimes impossible, to remove from cowgrass seed during machine dressing. Other weed seeds such as dock are often found in samples of cowgrass seed, but dock seed can be removed if the percentage is not high.

One of the most common causes of cowgrass lines failing to attain a satisfactory standard of purity is the presence of chipped seed or seed damaged by insect pests. Chipping or damaging of seed during threshing in the field can be avoided by proper attention to correct heading or huller technique. Insects such as the clover chalcid, however, may cause damage to the seed and often such damaged seed cannot be removed from the sample.

Honey dew secreted by aphids in the flower heads of cowgrass has been known to cause stickiness of the seed when harvested. This may make machine dressing difficult. However, if carbonate of lime is mixed through seed affected in this way, the trouble is overcome.

Yields

Yields of seed from cowgrass vary considerably from district to district as well as from year to year. Areas in the Kaituna Valley, Marlborough, have yielded over 1,100 lb. per acre off the clover huller with an estimated loss of 5 to 6 per cent. in machine dressing. These yields were obtained some years ago and exact machine-dressing figures are not available. Exceptional yields in recent years have fallen somewhat short of this figure, though one area of 5 acres sown in the spring of 1947 in the Kaituna Valley yielded 988 lb. of machine-dressed seed per acre in its first harvest (1948-49).

Though such yields are exceptional, they are an indication of what can be achieved under favourable conditions. However, average yields are the only reliable ones for estimating expected yields in any district. In this connection a comparison between yields in the Kaituna Valley and the Wairau Plain in Marlborough is of interest.

The average yield of machine-dressed seed from 30 paddocks taken at random in each district for the 1947-48 season was as follows:

Kaituna Valley	Wairau Plain
418 lb. per acre	230 lb. per acre

A further comparison, giving successive harvests from 16 paddocks in the same two districts, is as follows:

District	1947-48	1948-49
	lb. per acre	lb. per acre
Kaituna Valley	403	319
Wairau Plain	207	84

The poorer yields on the plains land are probably due mainly to two factors —poor fertilisation and less favourable moisture conditions. Yields on the Wairau Plain are probably similar to, though still above, those yields on the more extensive Canterbury Plains.

Certification

Originally, cowgrass was certified in one class only under the description "N.Z. Grown Broad Red Clover". This scheme provided a reasonably even type of this early-flowering red clover in contrast to the late-flowering Montgomery red clover.

Some years ago, however, selection work was carried out and this work culminated in the release in 1947 of a quantity of seed of pedigree strain. This is a higher-producing and more uniform type than the natural type and goes under the more convenient name of "cowgrass".

The new scheme has brought cowgrass certification into line with the system used for most other seeds, the different classes being Government Stock, Pedigree, Mother, and Standard.

Diseases and Pests

The cowgrass crop does not suffer greatly from disease or pest attack

apart from the parasite broom rape (*Orobanche minor*). In areas where the crop is grown extensively this parasite can cause considerable damage.

Broom rape is a leafless plant which attaches itself to the roots of the clover or other plants such as dandelion, living entirely on nutrients taken from the host plant. No green colouration (chlorophyll) is present, for the plant is a perfect parasite.

Growth starts from extremely small seeds, which are as fine as dust, and it is estimated that one plant may produce nearly 120,000 seeds. On germination of the seed a root is sent out and this, if it touches a cowgrass root or the root of any other host plant, immediately penetrates the host root and begins to suck nutriment from it.

Though a light infection of broom rape does little harm to a cowgrass crop, a heavy infestation greatly weakens the clover. At present no control methods are available apart from crop rotation, but it is thought that certain types of weedkiller might be effective against this parasite.

Dodder (*Cuscuta epithymum*) is another parasitic plant which sometimes attacks cowgrass. However, this parasite is not nearly as common as broom rape, and owing to its relatively low incidence it cannot be considered of any great importance, though dodder seeds in clover are a serious impurity.

The plant begins growth from a small seed which sends up a thin, thread-like twining stem. If this stem touches a suitable host, such as a white or red clover plant, it inserts tiny suckers into the tissues of the plant and begins to feed on its juices, sapping its vitality. A single parasitic plant may invade several square yards of clover.

As this parasite is an annual, it depends on reseeding for its continued existence in a paddock. It may be controlled by mowing to prevent reseeding, and care should be taken to cut and destroy any dodder patches in a cowgrass seed crop, the essential factor being to cut early enough to prevent any seed falling to the ground.

Clover-seed chalcid (*Bruchophagus gibbus*) is a minute black wasp which was reported as being injurious in cowgrass seed crops as far back as 1921, and it is probable that the insect does more damage than it is given credit for at present.

The females lay eggs in the withered clover heads at a time when the seeds are fully grown, but juicy. The larva after hatching out penetrates the seed and feeds on the contents with the result that the seed is made useless, only the shell remaining. However, the larva remains enclosed in the seed-case until spring, with the result that the affected seed remains heavy and is not removed during machine dressing. The pest thus perpetuates itself by the sowing of affected seed.

Lucerne is also a host plant for this pest.

Aphids: Though damage to cowgrass through aphid infestation is not great, in some localities the crop suffers from this type of attack at certain times of the year.

Some districts probably do not experience any aphid infestation of cowgrass, but in dry, hot localities this pest is sometimes prevalent and is often found in damaging numbers on cowgrass crops before the hay cut is taken. Occasionally, too, aphid infestation at a later stage has resulted in considerable amounts of honey dew being deposited in the seed heads, making the threshed seed sticky.

Aphids are sucking insects, and when they are on a crop in large numbers they can sap the vigour of the plants, especially when soil conditions are fairly dry.

Clover thrip (*Haplothrips niger*) is the small red thrip which is exceedingly common in the seed heads of red clover. It is not known if this insect causes any appreciable damage to cowgrass seed crops, but it certainly cannot have a very harmful effect, as it is frequently noted that crops which have yielded extremely well have been heavily infested with the pest.

Clover case-bearer (*Coleophora spissicornis*): The adult of this pest is a small moth about ½in. long. It has shiny, brassy-bronze wings, becoming coppery toward the tip.

Though this insect has not been recorded as damaging cowgrass seed in New Zealand, quite possibly it does so, as it has been recorded as doing this overseas. It commonly attacks white clover seed in this country, part or all of affected seed being eaten by a small light-yellow caterpillar.

Conclusion

Cowgrass has given the farming community a service which has been both long and beneficial, and there is every indication that this good performance will be maintained or perhaps enhanced in future, for the recently introduced pedigree strain will undoubtedly result in a higher-producing and more even type of clover than that which has been available in the past.

Though fluctuations in price are likely to have a profound influence on seed production in some parts, the districts where high yields are the rule will not be seriously affected, for there will always be a strong local demand for this popular clover in spite of any adverse developments interfering with trade overseas.

Meteorological Records for February

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	69.8	+3.2	85.3	50.5	11.23	16	+ 7.06	5.19	23	145
Auckland	160	70.6	+ 3.9	82.8	56.1	11.18	9	+ 7.27	4.91	16	160
Tauranga	10	68.3	+ 3.3	83.7	50.2	7.17	15	+ 3.44	2.20	24	176
Ruakura	131	67.6	+ 4.3	84.7	47.1	12.75	11	+ 9.67	4.06	17	150
Whakarewarewa	1006	66.0	+ 3.6	82.3	47.8	10.04	11	+ 6.12	2.78	24	129
Gisborne	14	68.8	+ 3.7	87.9	41.2	1.96	9	— 1.09	0.64	19	214
New Plymouth	160	66.6	+ 4.1	80.0	48.3	5.12	15	+ 1.14	2.56	24	154
Karioi	2125			81.0		4.13	11	+ 0.08	1.50	24	
Napier	5	69.0	+ 3.6	89.2	45.4	2.94	7	+ 0.26	0.80	17	216
Wanganui	72	66.8	+ 3.1	84.6	48.4	3.59	8	+ 0.62	1.39	24	157
Palmerston North	110	66.4	+ 3.9	83.2	46.5	2.53	9	— 0.56	1.00	24	168
Waingawa	340	66.6	+ 4.2	88.5	40.7	4.87	10	+ 2.06	2.09	24	200
Wellington	415	63.2	+ 1.9	77.0	44.3	6.64	10	+ 3.36	4.23	24	168
Nelson airfield	5	64.5	+ 3.3	82.7	44.0	5.82	11	+ 3.20	2.19	17	128
Blenheim	12	65.8	+ 3.0	83.3	41.1	4.64	12	+ 2.50	1.97	17	191
Hokitika	15	63.4	+ 5.3	77.1	47.9	12.14	21	+ 4.41	3.18	14	112
Hanmer	1270	62.0	+ 2.6	89.0	35.0	6.59	14	+ 2.94	2.13	24	144
Christchurch	22	63.5	+ 2.7	91.0	38.9	1.07	11	— 0.73	0.24	14	125
Ashburton	333	62.6	+ 1.6	91.4	40.2	2.48	11	— 0.21	0.68	23	122
Timaru	56	61.0	+ 0.8	88.5	43.9	2.62	13	+ 0.40	0.90	23	111
Alexandra	520	63.8	+ 2.4	89.2	41.2	2.83	11	+ 1.36	1.43	21	139
Taieri	80	58.9	+ 2.1	85.6	33.8	3.48	9	+ 1.17	1.70	21	127
Invercargill airfield	0	58.5	+ 2.3	80.9	32.5	4.22	8	+ 0.87	2.14	21	190
Chatham Islands	140	60.1	+ 1.7	70.0	41.4	3.06	11	+ 0.67	1.45	19	

Tussock Grub Control

By H. M. SIEVWRIGHT,
formerly Fields Instructor, Department of Agriculture, Lake Tekapo

THE tussock grub, the larva of the native moth (*Persectania aversa*), is ever present in New Zealand's tussock grasslands. In some years its activities result in severe mortality, especially of hard tussock (*Festuca novae-zelandiae*). Recent investigations have shown that even severely grub-damaged tussock areas can be rejuvenated within 4 years by judicious management aimed at improved nitrogen and phosphate status of the soil.

AS a consequence of widespread outbreaks of grub damage in the Mackenzie Country in 1950-51 the Entomology Division, Department of Scientific and Industrial Research, began investigations to determine the influences of the insect complex on tussock deterioration. At the same time the Department of Agriculture established a trial near Lake Tekapo with the object of rejuvenating and regenerating a grub-damaged area. The latter trial is discussed in this article.

The Department's experiment was sited in the centre of an area of about 1,000 acres of tussock severely affected by grubs. Observations at the time indicated that most, if not all, of the tussocks throughout the affected area were apparently dead.

Layout of Trial

Two adjoining ½-acre blocks were seeded and cross treated with lime and phosphate fertilisers on 13 October 1951. The seed mixture used on both blocks was:

	Lb.
Cocksfoot (*Dactylis glomerata*)	8
Tall oat grass (*Arrhenatherum elatius*)	6
Tall fescue (*Festuca arundinacea*)	6
Alsike (*Trifolium hybridum*)	2
Certified white clover (*Trifolium repens*)	2
	24

The seed was subsurface drilled on one block and surface broadcast on the other, part of the broadcast area being harrowed. Fertiliser treatments on each block were:

(a) Reverted superphosphate (3 superphosphate : 1 lime) at 2 cwt. per acre, and

(b) Lime at 2 cwt. per acre.

These basal treatments were crossed with superphosphate at 3 cwt. per acre on one strip and lime at 10 cwt. per acre on another.

The major portion of each treatment was enclosed in rabbit-proof fencing, the remainder being open to unrestricted grazing.

Progress Results

The initial establishment of clover was very satisfactory, the strike being twice as good on the drilled area as on that surface broadcast, though the latter showed improvement where it had been harrowed.

Within 3 months of sowing, seedlings were well established in both the enclosed and unfenced portions of the trial and there was an obviously marked response, both by sown and volunteer clover plants, to phosphate applications and to spelling, the mass of white flowers developed on this area being conspicuous over ½ mile away.

By May 1952 (7 months after sowing) clovers predominated throughout the topdressed swards, and though much of this early production came from volunteer clover, the successful establishment from sown seed was obvious from the noticeable drilled rows of plants, even in spite of continued grazing on the unfenced portions of the trial.

In the spring of 1952, some 11 months after sowing, the clover response to superphosphate (3 cwt. per acre) was outstanding. Within the enclosed, spelled area the mat of introduced and volunteer clovers was 6 in. to 8 in. high and the unfenced, grazed area showed vigorous clover growth. The observable response to lime was very slight.

The initial establishment of sown grass species was only fair. Cocksfoot showed best establishment and had made better initial progress on both

▼ Tussock which has been damaged by grubs.

An area which was previously affected by tussock grubs and which has been oversown and topdressed.

the ungrazed and intensively grazed, drilled sections when inspected some 16 months after sowing. Tall fescue was also moderately prominent, especially in the enclosed, spelled plots.

By this time applications of phosphatic fertilisers, especially superphosphate, had also encouraged the growth of other grasses and related species, sparsely present in the sward at the time of laying down. Notable among these were Kentucky bluegrass (*Poa pratensis*), plume grass (*Dichelachne crinita*), blue wheat grass (*Agropyron scabrum*), and *Carex breviculmis*.

Also, at this time, it was evident throughout the whole area that many small tussocks were re-establishing from what had formerly appeared to be dead butts.

The results at this stage—February 1953, 16 months after the beginning of the trial—indicated that clovers and cocksfoot could be successfully introduced into grub-depleted swards, even under intensive grazing, and that under spelling these sown species flourished and produced a considerable bulk of forage, especially where seed had been originally subsurface drilled and 3 cwt. per acre of superphosphate applied.

There were also indications that topdressing had invigorated grasses and related species natural to the area and there were signs of recovery of grub-damaged tussocks that had appeared dead.

The trial area was again inspected in June 1953, and after 20 months' growth the superphosphate-treated, spelled plots contained a mat of clovers and cocksfoot with herbage still remaining green into the winter. The fencing on the area was removed at this stage and the plots exposed to normal run grazing management which consisted of winter and spring grazing with half-bred sheep at the rate of 1 sheep to 3 acres.

Further inspections were carried out in the summer of 1953 and the autumn of 1954. The summer visit confirmed that an encouraging revival of tussock was taking place over the whole area, healthy tussocks being conspicuous throughout. Clovers were still responding excellently to superphosphate, and cocksfoot had developed well in all plots. The removal of the fence resulted in considerable concentration of stock on the trial area.

Further progress in the revival of tussock was noticed in the following autumn inspection, the whole of the area formerly affected by grubs having become well covered in healthy, grub-free tussocks up to 12 in. high while under normal grazing management.

Re-establishment of tussock had, however, been affected within the formerly enclosed area, where the smothering effect of vigorous, spelled clovers and the subsequent concentrated grazing of stock, once the fence was removed, had virtually, though not entirely, eliminated any tussock regrowth. This was especially so on the superphosphate plots where growth of sown and volunteer species was most prolific and grazing most concentrated.

Where the area had been seeded and fertilised but had remained open to grazing since inception tussock recovery corresponded with that obtained throughout the grub-affected area generally, and clovers and cocksfoot formed a fairly productive sward within the inter-tussock spaces.

Conclusions

Within 4 years the trial has shown that on this area of hard tussock which has been so severely damaged by tussock grub as to indicate that most if not all tussocks were apparently dead, the tussock cover could be satisfactorily rejuvenated while, at the same time, a productive sward of clovers and grasses was established.

Under the local environmental conditions (Omarama stony sandy loam soil type with an average annual rainfall of 22 in. at an altitude of 2,400 ft.) the successful rehabilitation of grub-depleted tussock can be ensured and the carrying capacity of the area greatly improved. Success lies in spring drilling a clover-cocksfoot seeds mixture with superphosphate at 3 cwt. per acre, and by judicious grazing management ensuring that (a) the initial spelling of the area, though of sufficient duration to permit strong establishment of sown species, is not prolonged to the stage where vigorous clover growth will smother out regenerating tussock; and (b) subsequent grazing is such that reviving tussocks are not grazed out of the sward.

More recent field observations of grub-damaged areas indicate that the recovery pattern is similar to that obtained in the results of the Tekapo trial. Wherever there has been a stimulation of legumes by superphosphate a marked tussock regeneration has occurred and no grub damage has been noted where a thriving legume has stimulated the tussock.

The whole of the area damaged by tussock grub in 1950-51 and in which the trial was located is well covered in healthy tussock today and where clovers and cocksfoot were introduced they continue to flourish.

FARMING IN NEW ZEALAND

THE dairy cow and the name Taranaki have been synonymous for many years, and though other forms of farming have been developed in the district, the adequate and well distributed rainfall and suitable topography of much of the province are likely to keep dairy farming the dominant farm enterprise. This article by A. C. Burgess, Instructor in Agriculture, Department of Agriculture, New Plymouth, traces the development of farming in Taranaki and shows how its environment has moulded the present farming pattern. In this first section of the article the author deals with topography, climate, and soils of the province, early settlement of the district, and the rise of the dairy industry. The second section of the article, to appear in next month's issue, will describe the development of the sheep industry, and the third section, to be published later, will discuss the development of a Taranaki dairy farm in the last 20 years.

THOUGH the Taranaki Land District consists of the counties of Ohura, Clifton, Stratford, Eltham, Inglewood, Taranaki, Egmont, Waimate West, and Hawera, the county of Ohura is usually associated with the King Country, and Patea in the southern part of the district, though partly in the Wellington Land District, is usually considered to be part of Taranaki. Therefore in this article Ohura County has been excluded from, and Patea County included in, Taranaki.

Heading photograph by National Publicity Studios.

Land Utilisation

The total area occupied for farming in Taranaki is 1,440,000 acres, of which 945,000 acres are in grass, 20,000 acres in crop, and 9,000 acres in plantations, etc., and 465,000 acres comprise unimproved farming land. About 273,000 cows are milked and 850,000 breeding ewes are run.

Topography

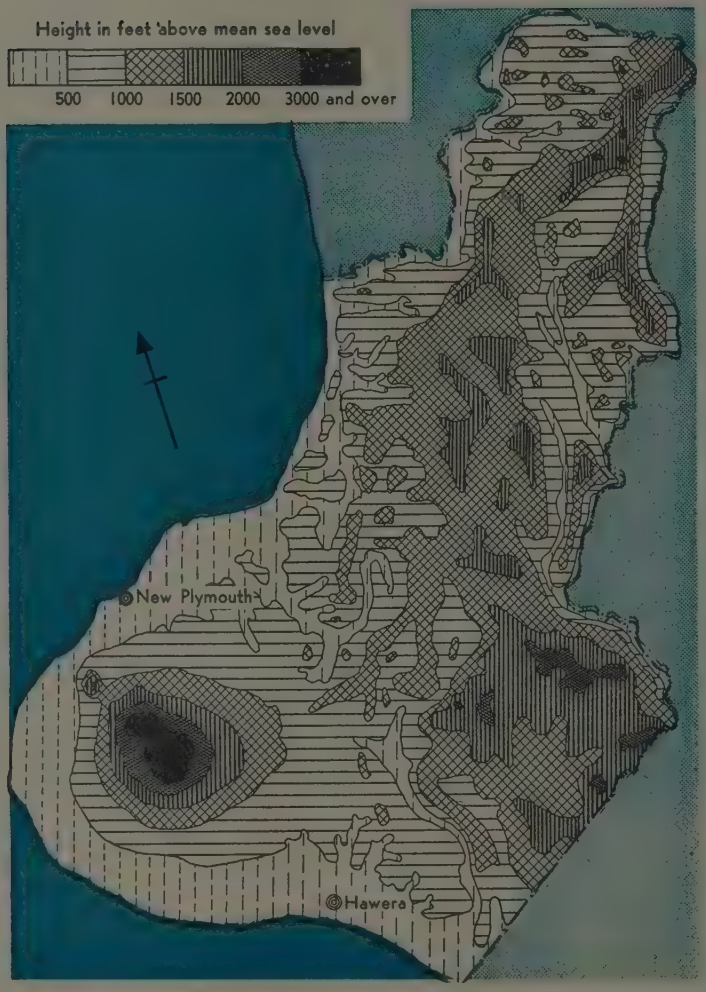
Taranaki can conveniently be divided into three topographic regions—north and north-east upland, Egmont or western Taranaki, and east and south-east upland.

North and North-east Upland

Though called upland, the area is of relatively low altitude, but the broken nature of the surface gives it a very rugged appearance. The coastline of the region is being eroded and is thus nearly everywhere cliffed, these cliffs usually being about 100 ft. high, though in places they reach from 500 to 600 ft. Inland from the coast the hills rise gradually from approximately 700 ft. to nearly 2,000 ft. on the eastern edge of the region, which merges into the central volcanic plateau. Some of the hills are very steep and at the base meet in narrow, V-shaped valleys; others are of a more gentle slope with some intervening flat areas between the slopes. The streams and rivers of this section frequently flow in deeply entrenched beds.

About 15 to 20 miles inland from the coast there is a somewhat indefinite range of hills, the Damper Range, which forms the eastern watershed of

TOPOGRAPHY OF TARANAKI



the rivers draining to the west coast such as the Tongaporutu and Mohakatino Rivers, and from the eastern slopes there rise some tributaries of the Wanganui River. These tributaries, which flow in a southerly direction, drain the eastern part of the region.

Egmont or Western Taranaki

In Egmont or western Taranaki Mt. Egmont (8,260 ft.) is the dominating and central feature. Circling it and the Pouakai Range there is what some geologists describe as a ring plain. However, this plain cannot be likened to such flat areas as the Canterbury and Heretaunga Plains, for it is gently to easy rolling country, varying considerably in altitude. For instance, at Inglewood railway station it is 657 ft. above sea level, but at Stratford it is 1,012 ft. The approximate slope of the plain for 6 or 7 miles inland is usually between 60 ft. and 90 ft. per mile, but it becomes greater nearer the mountain. Adjoining Mt. Egmont to the north-west is the Pouakai Range, about 6 miles long and reaching its highest point of 4,590 ft. on Pouakai Peak.

A little further to the north-west is an isolated, irregular set of hills occupying 10 to 12 square miles of country; this is the Kaitake or Patua Range, with Patua Peak at 2,290 ft.

On the ring plain from just south of Okato to Opunake a dominating physical feature is the large number of conical hills ranging in height from a few feet to approximately 40 ft. and with a number of swampy hollows. These conical hills originated from a gigantic mud flow from Mt. Egmont which covered this section down to the coast.

A distinctive feature of the division is the radial pattern formed by the numerous streams flowing down from Mt. Egmont and the Pouakai Range. To the north, west, and south of Mt. Egmont many of these streams pursue independent courses to the sea. When they issue from Mt. Egmont they flow through gorges which deepen for some distance down the mountain but which become less deep on the lower slopes and which on the ring plain become shallower channels, though there they are frequently 20 ft. to 60 ft. below the surrounding country.

East and South-east Upland

This is the highest of the Taranaki back country, the altitude of practically all of it being between 1,000 ft. and 2,000 ft. and some is higher. It is very broken, much of it is still in bush, and the area is strongly dissected by stream action. The Wanganui, Waitotara, and Whenuakura Rivers and their tributaries drain the area.

Climate

Taranaki has a maritime climate, since it has over 150 miles of coastline directly exposed to the prevailing north-westerly winds coming in from the Tasman Sea.

Mt. Egmont has a dominating influence on the climate of the district and, though it is an isolated cone, its influence on rainfall is great. The annual distribution of rainfall is indicated on the accompanying map, which shows clearly the increased rainfall on the upper slopes of the mountain. Though an area is shown to have an annual precipitation of over 200 in., it is possible that there is a zone which has as much as 300 in. a year.

The annual rainfall round the coastal section of the district is between 50 and 60 in., New Plymouth, for instance, having 59.8 in. and Cape Egmont 57 in. However, South Taranaki, which is really in the rain shadow area of the mountain, has an annual fall of under 50 in. Hawera, which is in this zone, receives an average of 45.4 in. In the north and east upland the annual fall

MEAN ANNUAL RAINFALL IN TARANAKI*

Rainfall recording station	Inches
Tangarakau	70.29
Waitara	56.06
New Plymouth	59.87
Cape Egmont	57.07
Lepperton	80.58
Inglewood	92.18
Stratford	80.03
Hawera	45.47

* From the New Zealand Meteorological Service's Miscellaneous Publication 109 (1952).

ranges from 60 in. on the narrow coastal section to between 70 and 100 in. over the remainder of the area.

Rainfall is well distributed, but summer and early autumn are definitely drier than the remainder of the year, February generally being the driest month. May, June, and July are very wet, with a falling off in August, but the decrease is not continuous, as it is checked in spring owing to rains brought in by the westerly winds, which are most frequent at that season. These heavy and frequent rains in spring are very important to Taranaki to get the pastures away to a good start. Summer rainfall is not as reliable as that at other times of the year and rather prolonged dry spells are not infrequent.

Except on Mt. Egmont, where snow frequently lies down to 3,500 ft., no part of Taranaki is inconvenienced by snowfalls.

Unfortunately New Plymouth is the only climatological recording station in Taranaki and there is therefore no information about other climatic elements for the remainder of the district. At New Plymouth the mean daily temperature ranges from 48.6 degrees F. in July to 62.7 degrees F. in January. Frosts are not severe there and the average number for the year is only 17.

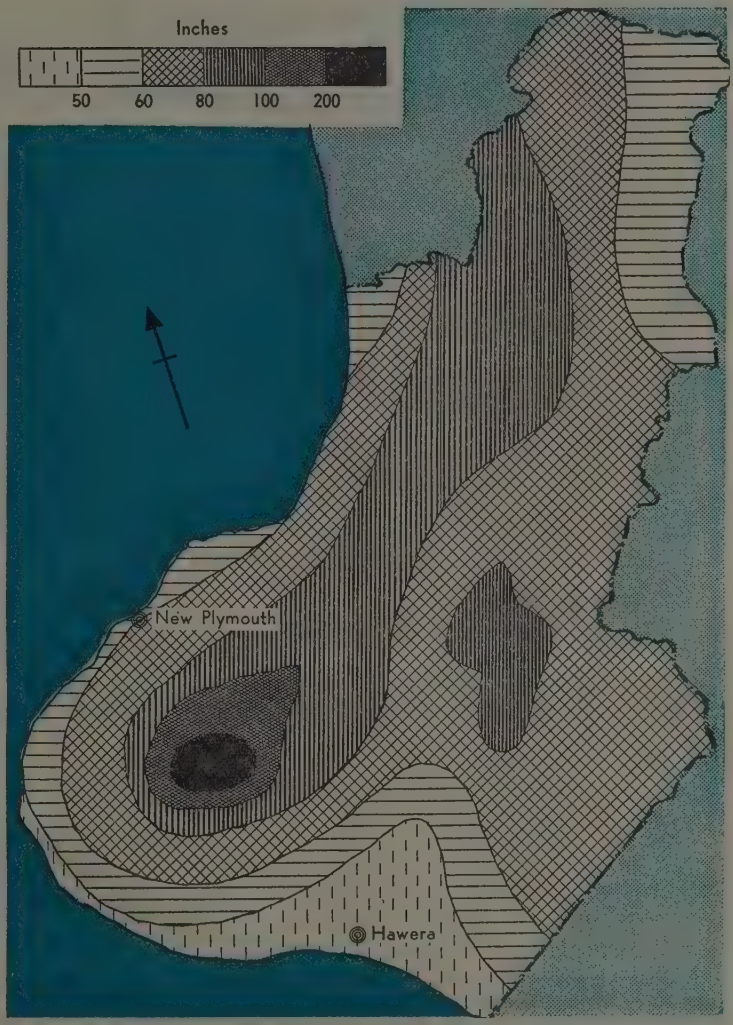
In inland districts the position is different, as the mean temperature range is much greater and severe frosts are general in winter. For instance, frosts of 10 to 12 degrees are common at Stratford.

As rain falls on an average of 189 days a year at New Plymouth, the annual average of 2,234 hours of bright sunshine a year is relatively great. Nelson, which has one of the best official records for New Zealand, has 2,486 hours of bright sunshine a year. Thunder and hail storms are rather more numerous in many parts of Taranaki than in other districts. New Plymouth has an average of 12 of these storms a year.

The prevailing winds are from a north-westerly quarter and south-westerlies are also rather frequent. However, when the wind blows through Cook Strait from a southerly direction south-easterlies generally prevail in Taranaki. These winds bring rain to South Taranaki and as far north as Stratford, but the remainder of the district, including the coastal area north of Opunake, seldom receives rain from this quarter. However, as these winds are very cold and frequently give a decided check to pastures, they are an important climatic factor affecting production.

On the south side of Mt. Egmont the prevailing north-westerly wind is frequently dry and thus the effect of rainfall in the Hawera district is reduced.

MEAN ANNUAL RAINFALL IN TARANAKI



A temperate climate with adequate and well distributed rainfall has certainly been a major factor in the development of Taranaki as one of New Zealand's major dairying districts.

Soils

The soils of Taranaki can be divided into two broad groups—skeletal and volcanic.

The mudstone and sandstone soils of the steeper country of eastern Taranaki are known as skeletal soils. They have been formed from sea-deposited sediments. After being raised up out of the sea the country has been deeply dissected by movements and erosion.

The quality of these soils varies considerably. There are small areas of soft, light grey papa (a mudstone) which is of very high natural fertility and which under farming supports high-producing pasture. There are other fairly large areas of coarse sandstone in odd places throughout the province, especially in the south-eastern parts, that are of very low fertility, and most of the steep hill country is intermediate between these two types and is of low to medium natural fertility.

The volcanic soils are derived from volcanic ash erupted from or near Mt. Egmont and cover all the western area of Taranaki. Small areas of easy rolling to flat country in the eastern upland have a volcanic topsoil, but generally the steep nature of this country has prevented it from keeping any of the ash covering which may have been deposited on it.

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On the ring plain from just south of Okato to Opunake a dominating physical feature is the large number of conical hills, which originated from a huge mud flow from Mt. Egmont.

Three main ash showers are recognised:

1. **The Egmont shower**, which covered the whole of the Taranaki Province.

2. **The Stratford shower**, which overlies the Egmont shower for about 25 miles north, east, and south of Mt. Egmont. It extends less than 10 miles to the west owing to the prevalence of westerly winds during the eruptive period.

3. **The Burrell shower**, which covers the Stratford shower for 8 to 9 miles east and south-east of Mt. Egmont and which is estimated to have erupted less than 500 years ago.

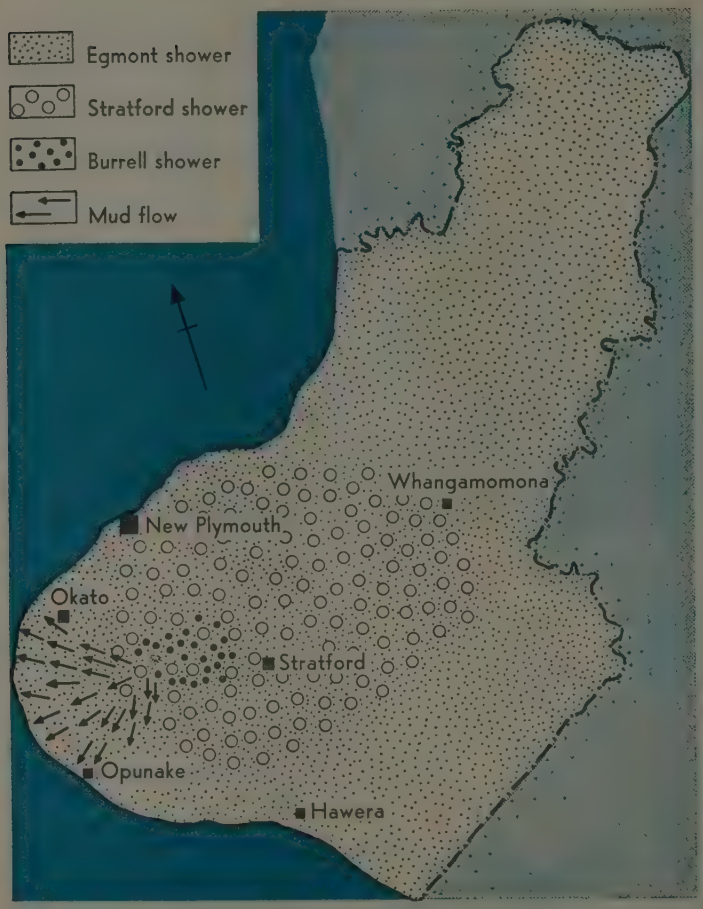
In addition to differences due to the parent ash shower, soil differences arise from variations in vegetation or climate. For example, along the coast the native vegetation was fern and coastal scrub and the soils are black. Further inland, where native forest covered the land, soils formed from the same material are brown. In higher-rainfall areas soils are more leached and form separate types from those where rainfall is lower.

In the area from Okato to Opunake the ash fell on the hilly and

Hummocky land from Opunake to Rahotu on the coastal area around Mt. Egmont is sometimes difficult to lay out well, but hummocks provide ample shingle for farm roads.

Shingly subsoil in hummocky area near Opunake hinders natural drainage, and extensive drainage work is necessary.

ASH SHOWERS FROM MT. EGMONT



hummocky land formed by gigantic mud flows which had come from Mt. Egmont and during soil formation of the underlying material has become mixed with the ash to produce bouldery soils.

On the valley flats soils are formed from mixed volcanic ash and papa or sandstone washed off the hills and deposited by streams. They are termed recent soils.

In the Tariki, Stratford, and Eltham districts there are areas of peaty soils with a permanent high water level. They are formed from a mixture of partly decomposed organic material and volcanic ash.

The subsoil of most of the volcanic soils is quite porous and the soil is therefore naturally well drained. Exceptions are the peat soils mentioned above and the heavy swamp or gley soils in the Rahotu-Oaonui, Pihama-Kapuni, and Tariki-Inglewood areas. Extensive iron pans occur in these areas 2 or 3 ft. below the surface.

EARLY DEVELOPMENT OF THE PROVINCE

The first white settlement in Taranaki was established in 1829, when the well known Dicky Barrett set up a whaling station at the Sugar Loaf Islands. This settlement, however, played no part in laying the foundation of the future history of the district.

The Plymouth Company of New Zealand was formed at Plymouth, England, on 25 January 1840 with a capital of £150,000 for the purpose of acquiring land in some part of New Zealand and settling it with people from Devonshire and Cornwall.

A surveyor, F. A. Carrington, was sent out to New Zealand in 1840 to select the site for the settlement and he chose Taranaki because of the high fertility of the land and its suitability for farming. This marked the beginning of the settlement of Taranaki.

The first settlers arrived on 31 March 1841, when the barque William Bryan dropped anchor off New Plymouth with 148 passengers from the west of England. They immediately set forth with a will to establish their homes in this strange land, which was mainly bush covered and where the only inhabitants were fierce looking and dark skinned.

The unsuitability of the coastal area for shipping was a serious disadvantage, and the unloading of ships had to be done by surfboats, a slow and often dangerous job. Clearing and working of the land were begun soon after the settlement started and naturally the first crops grown were food crops.

A writer says of New Plymouth in the early days of the settlement:

> In attempting to cut lines the perplexed surveyors found that the irregularities of water courses, broken ground, and mounds completely capsized their ideas of success in following out those of the projectors of the township, who had evidently surveyed in their mind's vision none other than a dead level country.

By 1843 there were 250 acres under cultivation, and on this were grown mainly wheat, potatoes, and maize. In 1842 Captain King had a small flock of Merino sheep and W. Devenish had a flock of Southdowns which he had carefully reared from a few he had obtained from the captain of a vessel which visited the port.

E. J. Wakefield, writing of a visit he paid to Taranaki in 1842, said:

> The population of New Plymouth seemed a particularly happy set of people . . . . on going to their little farms I found them hard at work, delighted at the fertility of the soil which they were turning over, and with hardly a complaint to make.

A flour mill was erected near New Plymouth in 1843 on the Huatoki Stream. By 1846 there were 1,163 acres in cultivation, of which 838 were in wheat and 133 acres were sown in grass. By 1849 there were 783 acres in grass.

In 1848 a correspondent wrote:

> The timber and the big bush is cut down in a rough way and allowed to lie for 6 months when it is burnt, the fire consuming the wood except heavy logs and the stumps. The wheat is sown and scraped in the ground in a rough and light manner and, without grubbing, a crop of 50 bushels to the acre is fairly sure.

The Maori Wars, 1860-69

Early relations between the white settlers and the Maoris were quite good and development was carried on systematically and smoothly. However, trouble arose with the Maoris over land titles and these disputes eventually resulted in war in 1860. This was waged very bitterly at times during the following year. A second war began later because of a further dispute over land, peace finally coming to the district in 1869.

The Maori Wars caused a serious setback in the early development of

the district. At the end of the wars there were few signs of prosperity; settlers had lost their homes, their cattle, and their fences, and people were still nervous of further Maori attacks. Heavy confiscations of Native lands followed, however, and the major development of Taranaki began at this time.

A series of military settlements was established along the coast in various places and these were composed of men enlisted for the purpose. They had to serve for a few years as a military force and in return each was settled on 50 acres of land confiscated from the Maoris. The confiscation policy vastly extended the area available for settlement. From about 1869 the occupation of land extended from both north and south along the railway line being built between New Plymouth and Hawera.

Establishment of Settlements

As the railway pushed south from New Plymouth the bush was cleared and settlements were established. The Moa Block, where Inglewood now stands, was opened up and the first sections were sold in January 1875. Settlers there at once began clearing the bush. The railway from New Plymouth reached Inglewood in August 1877 and by December 1879 it had reached Stratford. The first clearing in the Stratford area had appeared in 1877.

In an article "Taranaki Forest and Forest Farming" Thomas Kelly, writing in the "New Zealand Country Journal" in October 1877, gives the following interesting description of the work of clearing the country. It gives a good picture of conditions of the early settlers.

The time for felling the bush in order to ensure a good burn in at the proper burning season—which is generally most favourable about the beginning of February—is from August to October. The felling ought to be completed by the first week in October. . . . The cost of felling bush . . . varies from £2 to £2 10s. per acre. When the owner does his own felling, an acre a week is considered good work, but this involves more than 48 hours per week. . . . it remains drying until . . . February. During that month, after a few weeks of hot weather without rain, the opportunity should not be lost of firing it, provided there is a favourable wind. . . . In April, the grass seed is sown, about 2 bushels of mixed seed being sown to the acre and a few pounds of clover seed. This ensures a thick crop of grass, and prevents the weeds obtaining a hold on the land. In 4 months there is generally feed for cattle. . . . Having burnt his clearing, the settler may either lay it to grass . . . for grazing purposes, or may utilise it for raising grass seed. If the latter is his object . . . 7 lb. of cocksfoot grass seed is sown to the acre. . . . The object is to spread uniformly the small quantity of seed over an acre to ensure at regular intervals detached tussocks of grass. This mode of sowing is found to give the best results, as the plants are vigorous, and produce abundance of strong seed stems. During the first seed season . . . the weeds come up between the grass plants and appear to choke them . . . only about half a crop is obtained the first season. After that the cocksfoot gradually shows its inherent vitality and power and before the next season . . . it completely crushes out all vegetable rivals and remains master of the position. . . .

As a general rule the occupier cannot keep stock and raise a full crop of seed as well. . . . The working settler with small means generally confines himself to raising seed for the first few years, and gradually merges into the composite occupation of raising both seed and dairy produce as his clearing enlarges. The gross produce of an acre of good land from the sale of grass seed is about £10.

. . . there is an abundance of good allotments of forest land to be obtained in Taranaki, within 3 miles of a railway in course of construction, where persons who desire to enter on a course of industry . . . may have their choice of allotments at prices . . . from 20 shillings to 40 shillings per acre, and where by frugality and ordinary industry a man of small means may in a few years provide a home for himself beyond the reach of poverty.

DRAINAGE PATTERN OF TARANAKI

According to an article in "The New Zealand Farmer" of November 1887 the cost of buying, clearing, and sowing down 1 acre of bush land was:

	£	s.	d.		£	s.	d.
Purchasing land	1	10	0	or	2	0	0
Felling bush	1	10	0	or	1	15	0
Grassing		10	0	or		11	0
Fencing		12	2	or		13	0
	4	2	2		4	19	0

Fencing was with 3 plain and 2 barbed wires and with 8 posts to the chain.

Another article, in the April 1889 issue of the same publication, describes the return from cocksfoot seed:

Cocksfoot has become one of our chief products, and this season's harvest will show a great increase in the quantity of seed which is available for export. Last year 55,145 bushels of cocksfoot were produced in the Hawera district. . . . Unfortunately many farmers have been compelled . . . to sell their seed at a very low price; at present the seed is quoted locally at 1½d. to 2d. per pound. . . . The settlers who obtained the services of Natives for reaping were best off. The Natives went about in bands of 50 to 100 strong, and soon reaped a large paddock. . . . The Natives cut a paddock for a certain sum, or so much per

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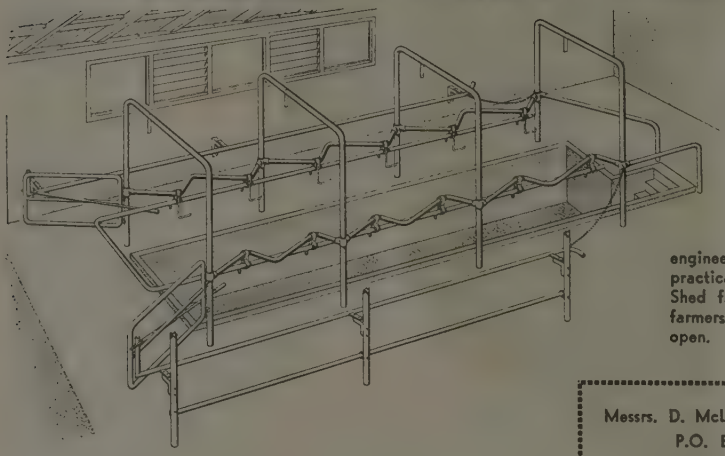

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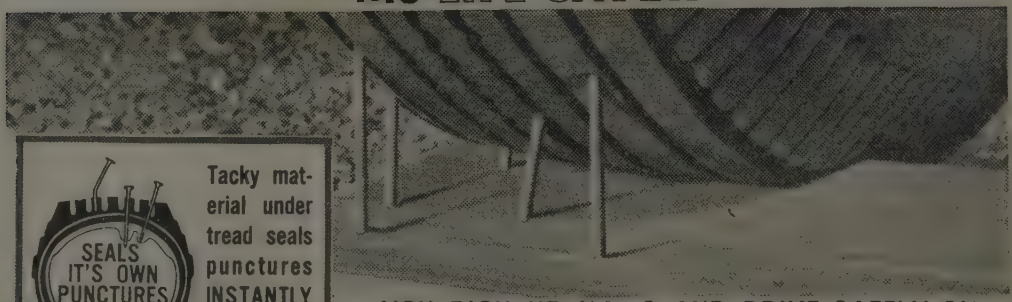

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acre. . . . The cocksfoot in Taranaki is all produced in the bush, and so far the grass has all to be cut with the reaping hook and threshed with the flail, and the average return of seed per acre is from 4½ to 6 90lb. bags.

Founding of Hawera

Hawera was founded during the Maori Wars, a blockhouse being built there in 1864. After the wars finished 50,000 acres of land was confiscated and reserved for men liable for military service. The first public sale of land on the Waimate Plains was held in Hawera in October 1880. Another sale was held in 1881, prices ranging from £4 an acre for open land and from £1 10s. to £2 an acre for bush land.

The open country was covered with tutu, fern, and flax and it was quickly brought into production. Most of the farms were stocked with beef cattle, dairying not being started until about 3 years after the district was first settled. Cropping the land with wheat, oats, and barley occupied much of the time of the first settlers in this district.

The railway line from New Plymouth to Hawera was officially opened on 20 October 1881 and the line from Wanganui to Hawera was opened in March 1885.

Eltham was prominent as a sawmilling town in its early years and the production of timber was begun there in 1884.

The site of Opunake was originally swamp, but it was a convenient place for troops to be disembarked. The town's first industry was, naturally enough, flaxmilling.

From these early beginnings the development of Taranaki soon began to proceed fairly rapidly. It was the spread of dairying in the district which was responsible for the most rapid increase.

W. K. Hulke, who brought the first Jersey cow into Taranaki. For many years he continued the breeding of Jerseys and was one of the outstanding pioneers of the breed.

DAIRY FARMING IN TARANAKI

[From the Alexander Turnbull Library photographic collection
A Taranaki home near New Plymouth in the 1870s.

EARLY DAYS OF THE DAIRY INDUSTRY

The first cow in Taranaki was owned by W. Henwood in 1842. Dairying, however, was carried out only as a minor part of farm operations for many years, and it was not until the 1880s that the industry really became established.

In the early years of settlement the main cattle were a dual-purpose type and the Shorthorn breed was the most popular.

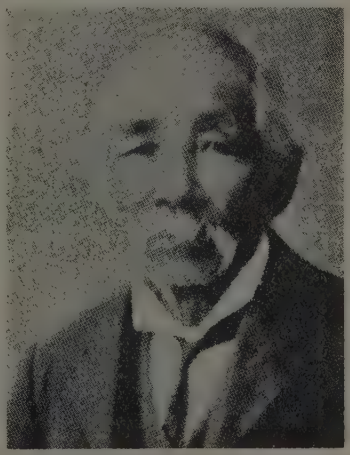
The first Jersey to be brought to Taranaki was bought by W. K. Hulke, of Bell Block, near New Plymouth, from Mrs A. W. F. Halcombe, of Marton in 1876. This cow "Jenny", for which Mr Hulke paid £40, was a daughter of "Lucy", by "The Old Marquis", which were two of the first three pedigree Jerseys to be brought to New Zealand from Jersey Island.

Mr Hulke continued the breeding of Jerseys for many years and was one of the outstanding pioneers of the breed. In the mid 1880s he established a model dairy factory on Corbett Road, Bell Block, for neighbouring farmers, where for many years he experimented in dairying, and he became a strong advocate of the dairy factory system.

Fungus or "Taranaki Wool"

Trading in a fungus growing on certain native trees was the mainstay of dairy farmers in Taranaki in the 1870s and 1880s. In his book "A History of the New Zealand Dairy Industry" H. G. Philpott says:

. . . it was not so much dairy produce as fungus which provided the means of keeping many Taranaki dairy farmers on their holdings between the years 1875 and 1885. The trade in Taranaki fungus was established by a Chinese named Chew Chong [who also played an important part in the development of the butter industry]. Chew Chong, during his wanderings as a pedlar of toys in Taranaki, recognised the fungus growing on the tawa, pukatea, and especially the mahoe trees as similar to an edible fungus greatly prized in China as a vegetable. . . . Chew Chong set about establishing a trade in fungus with his native land, and the venture was an immediate success. In 1885 the value of fungus exported is stated to have amounted to £72,000—more than the total value of butter shipped from the province. . . . It is difficult in these days to realise what fungus—commonly known as "Taranaki wool"—meant to the pioneer dairyman in that province. When Chew Chong commenced to purchase this commodity the settlers lived by a system of barter. Fourpence a pound was probably the average price for the butter they produced, while fungus brought about 3d. per pound. The storekeepers did not pay cash for the butter, however, but accepted it in exchange for stores, milled it, and shipped it Home in a salted condition in kegs as ordinary cargo. It was a matter of great difficulty to obtain sufficient cash to meet



Chew Chong, who was a prominent figure in the early days of the dairy industry in Taranaki.

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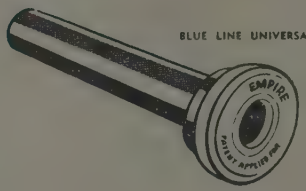

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the annual rates levied by the local bodies. . . . the joy with which they received spot cash for their fungus is not difficult to imagine.

The impetus given to dairying by the payment of cash for produce is indicated in the following extract from "The New Zealand Farmer" of December 1885:

What is putting new heart into the bush dairymen is a recent new departure in the butter trade. . . . Hitherto storekeepers would not give cash for fresh butter and value had to be "taken out". . . . Now, however, the Waitara Company have entered the lists and their buyer has his regular days in each week at the various settlements when he is ready to take all the fresh butter that comes along, at a fair price, for cash on the spot.

It must be remembered that these were still the days before butter factories and when practically all the butter was made on the farm.

Establishment of Dairy Factory System

Referring to the early history of factory manufacture in Taranaki, Philpott says:

Although Taranaki was somewhat late in the field, there having been many dairy factories in operation in other parts of the colony before Taranaki's first factory was built, this province developed its dairying activities more rapidly than any other province of New Zealand and subsequently became for many years the leading dairying district. The reasons for the delay are not far to seek. . . . the Maoris were a menace in Taranaki for some years after they had ceased to be troublesome in most other quarters. . . . Then again there was no suitable seaport throughout the whole coastline of the province; neither was there until 1885 railway communication with other parts of the Island. . . . As a result produce had to be transported overland to Wanganui or Wellington, a costly business and quite unsatisfactory before the days of insulated rail transport.

The first factory in Taranaki was established in 1882 or 1883, when Alfred Brake opened a private factory at Lepperton. Mr Brake collected the milk himself from nearby farmers.

The Moa Farmers' Co-operative Dairy Company's factory built at Inglewood was the first co-operative concern in Taranaki. Building of the factory began in 1884, but it was not ready to receive milk until May 1885.

Philpott says:

The original intention of the shareholders was to confine the factory's operations to the manufacture of butter. . . . on 21 July 1885 an additional £200 was subscribed to provide for the making of cheese. Mr A. Brake, of Lepperton . . . was engaged as manager for 12 months, at a salary of £2 6s. 6d. per week when butter only was made, and £3 6s. 6d. during the part of the year when cheese was made.

Early in its first season the factory nearly closed down owing to shortage of supply, but managed to carry on. The company lost £127 14s. 1d. on the first year's operations.

The Opunake Dairy Factory Company also opened a factory in 1885.

In addition to the help he was able to bring to Taranaki's early dairy farmers through the sale of fungus Chew Chong played an important part in the establishment of the dairy industry itself. Of his activities in the buying and selling of dairy produce Philpott comments:

The same year [1870] Chew Chong set up in business as a storekeeper and commenced buying butter from the farmers. . . . In 1874 and 1875 Chew Chong sent a number of consignments of butter to Australia, but the venture was most uncertain—sometimes he did well and at other times lost money on the shipment.

In 1884 Chew Chong left New Plymouth and opened a store in Eltham. Again he bought butter from the farmers, but could not sell it in New Zealand, so tried his luck with a shipment to England. He paid 4d. a pound for the butter, steamer freight was 3d. a pound, and he received 70s. to 75s. a hundredweight for it, so that with incidental costs he would lose money. The London report said, "Your butter is only like cartgrease". . . .

In 1887 Chew Chong built a butter factory at Eltham and called it the Jubilee Factory. . . . Later he erected creameries at Hunter Road, Te Roti, Mangatoki, and Rawhitiroa. . . . In 1889 at the Dunedin Exhibition Chew Chong won a silver cup for the best half-ton of butter packed suitable for export. . . .

Chew Chong rendered invaluable service to many dairy farmers in his district by way of financial assistance toward purchase of dairy cows, farm implements, stores, etc., and left behind him a lasting record of honest and often generous treatment.

Though dairying developed rapidly in many other parts of New Zealand, it was in Taranaki that the foundations of our present dairy farming practice were developed. Taranaki had all main essentials for dairying—light, fairly fertile soils, and an ample, well distributed rainfall. However, the pastures which had been established on the bush clearings soon showed signs of deterioration. The second phase in the development began with the stumping and logging of the land. The ash from the burnt logs and

TARANAKI IN 1880

stumps gave the grass the added stimulus required for the time.

MIDDLE DEVELOPMENT PERIOD, 1900-25

The period between 1900 and 1925 is perhaps the most important of all in the development of farming in the province, because it was the period when much hard work was required to clear and develop the land and farmers were faced with falling soil fertility and the need to intensify their farming methods if they were to stay on their farms. The time was past when men worked mainly on roads and railways and chopped the bush on their own farms in off-periods. Now farming was the full-time occupation of the men on the land.

Before pastures could be renewed the logs and stumps had to be removed and burnt. This was a slow and laborious process, but except on the coastal strip, almost every acre of grassland on the volcanic dairying lands of Taranaki has been cleared by hand, ploughed, cropped, and sown to grass.

Most of the pasture renewal in the early stages was done before the introduction of the improved strains of grasses and clovers through certification and this combined with the problem of falling fertility resulted in pastures deteriorating rapidly and becoming infested with such weeds as ribgrass, catsear, dandelion, ragwort, and many other weeds, including blackberry and gorse.

Some farmers were so discouraged by the inability to maintain vigorous pastures that they sold their farms and shifted to other districts, because they thought that there was no future to farming in Taranaki. However, the more progressive farmers realised that the applications of fertilisers would probably help to overcome the problem.

Bone dust and blood-and-bone manure were the first fertilisers used and were followed later by imported superphosphate and basic slag, which became very popular in Taranaki. With the increasing demand for superphosphate a fertiliser works began production at New Plymouth early in 1926. Though these fertilisers had a remarkable effect where they were used in sufficient quantity on large areas of the country, there was still a rapid decline in fertility, with resultant invasion of weeds.

A leader in the "Taranaki Herald" of 14 February 1910 commented on this serious problem:

> With regret we learn that noxious weeds, especially blackberry and ragwort, are rapidly gaining ground in some parts of the Province. . . . There are farms, we are told, which are becoming impenetrable thickets of blackberry, while the grazing capacity of others has been largely reduced on account of the spread of this and of ragwort. Farms which a few years ago carried a cow to 3 acres or less will not now graze one to less than 5 or 6 acres and the milk supplies to the factory have been correspondingly reduced.

These weeds, but especially blackberry, spread rapidly on land which has not been cleared of logs and stumps. Where ploughing was possible and some topdressing was used after sowing grass, blackberry was not a serious problem. However, on creeks and steep sidelings, especially where little or no fertiliser was used, blackberry has always been a serious problem.

> The Taranaki farmer's fight against blackberry, ragwort, and in some areas even gorse has been a continual one right up to the present day and his ability to cope with the problem has depended largely on the prices he has received for his produce.

When prices were reasonably good extra labour was engaged to clear weeds, but in periods of low prices only such work as the farmer could do himself was possible. In addition more fertiliser was used as prices rose and this helped considerably to check weed invasion.

When ragwort first appeared farmers pulled the plants when they were in flower and in this way kept the weed in check. As it spread to waste areas, where it was allowed to seed unchecked, control became more difficult and spraying or dusting with weedkillers became necessary.

Various types of weedkillers were tried with generally little effect. Sodium chlorate for the control of ragwort was first used in the late 1920s and from then the fight against it was largely won, though the weed sometimes becomes a menace again once the pressure is relaxed and on some farms it is still a serious weed today. As well as being notable for the hard work which had to be put into the development of farms the period is characterised by the fact that in it many of the important facilities and services associated with farming were developed.

Herd Testing

The production of the cows milked in the early years was very low and some farmers soon realised that if they were to make a reasonable living from their farms, herd improvement was of vital importance.

One of the first farmers in New Zealand to do his own herd testing was W. Burgess, of Warea, near Cape Egmont. In the 1906-07 season, when Mr Burgess started testing, his cows averaged only 198 lb. of butterfat, but 5 years later he had reached a production of 261 lb. per cow.

The Moa Farmers' Co-operative Dairy Company's factory at Inglewood was the first co-operative dairy factory in Taranaki. It began operating in 1885.

[*From the Alexander Turnbull Library photographic collection*

Toko, a small township a few miles from Stratford and a dairying centre, in the early 1900s.

The first herd testing group was started by the Department of Agriculture at Dalefield in 1909 and in the following year three more groups were formed, including one at Stratford.

Supplementary Feed

Crop trials were carried out regularly in Taranaki during this period at the Moumahaki Experimental Farm in South Taranaki and later at the Stratford Demonstration Farm. Swedes and chou moellier were both grown successfully and became widely used for supplementary feed in the district.

Cropping fitted in very well with the development of the dairying country, but from about 1910 onward a few farmers were making silage and by the end of the period this method of providing supplementary feed for dairy stock in winter was becoming widespread.

A system of all-grassland farming was made possible by the improvement of pastures through topdressing and the use of better strains of grasses and clovers which became available after the Department's seed certification scheme was introduced in 1929-30. However, because of the wide variation in production and persistency of strains of grasses and clovers produced in various parts of New Zealand "strain selection has unconsciously, but nonetheless surely, gone on in all arable-land-farming communities in New Zealand for the last 40 to 50 years."*

The effect of this of course in a district like Taranaki was that some farmers who had been using seed of a high-producing and persistent strain were able to develop an all-grass system of farming long before the majority could attempt it. Again some of the coastal land was flatter and had far fewer logs and stumps to be cleared than the more broken country inland and progress on this country was naturally more rapid.

Milking Machines

The greatly increased use of milking machines during the quarter-century up to 1925 is another notable feature. Though figures are not available for the early part of the period, D. Cuddie, of the Dairy Division of the Department, writing in the July 1913 issue of the "Journal" states: "During the last decade, and more particularly during the last 5 years, the installation of mechanical milking machines has been widely adopted in this country." This was a great advance in the efficiency of milk production, but it brought some problems, mentioned later by Mr Cuddie in the same article: "The large number of mechanical milkers now in use has had a distinct effect on the average cleanliness of the milk supplied to dairy factories. It has been generally recognised among the Dairy Instructors and factory managers for some time that while the milk from some farms using machines is satisfactory the major portion is more or less depreciated through the change from hand to machine milking." This problem of course has been reduced very considerably by the regular inspections of milking plants by Farm Dairy Instructors of the Dairy Division of the Department.

* Sir Bruce Levy, "The New Zealand Journal of Agriculture", July 1920, p. 2.

RECENT DEVELOPMENT, 1925-55

By the mid 1920s most of the logs and stumps had been cleared from the dairying land of Taranaki and the ploughable land cultivated, cropped, and sown to grass. From this time cropping became of less importance and farmers began to rely more on grass, hay, and silage for feeding their cows, and the use of artificial fertilisers became very widespread.

From 1925 to 1955 the area in crops decreased from about 26,000 acres to 19,500 acres, the area saved for hay and silage increased from 43,500 acres to 85,000 acres, and the area topdressed with artificial fertilisers increased from 226,500 acres (1927-28) to 600,000 acres. During this time the production of butterfat in the district increased from 40,000,000 lb. to 73,500,000 lb., an increase of 84 per cent.

The main factors responsible for this big increase in production are un-

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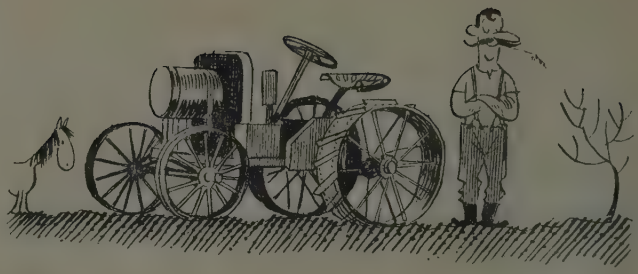

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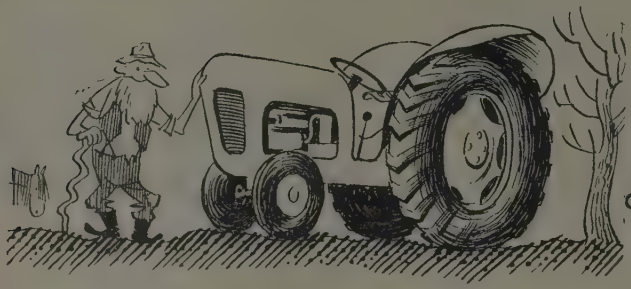

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doubtedly the increased use of fertilisers and the improvement in pastures through the use of better strains of grasses and clovers.

Topdressing with phosphate increased steadily from 1920, but potash, though recognised as being of great value by some farmers for many years, was not generally used. Since then more and more farmers have become aware of the value of potash, so that today it is almost universally used by dairy farmers and is just as important as phosphate for maintaining the fertility of Taranaki pastures.

On the volcanic soils lime has not been of great importance in the development of the country. The district's soils are fairly well supplied with lime and though some farmers feel that it must have some value, little or no response to lime is seen on pastures. Farm production and the use of phosphatic and potassic fertilisers have followed almost exactly the same trend during the past 25 years, but the fluctuations in the use of lime appear to have little relation to production. During the Second World War, for example, phosphate and potash were in short supply and in 1943 the amount used was little more than half of that used in 1941. Production was falling rapidly, yet at the same time the amount of lime applied increased considerably.

[From the Alexander Turnbull Library photographic collection
A dairy farm in the Toko district in the early 1900s.

Pastures

Though some outstanding production figures have been obtained by farmers who have not used a plough for 30 years or more, the best pastures are generally those which have been ploughed fairly recently and sown with good-quality certified seeds and properly topdressed and managed.

The average Taranaki dairy farm is far from flat, and, being often very much dissected by creeks, it is difficult to manage well. However, good management and utilisation of pastures have been achieved by many farmers in spite of great difficulties, and production has risen steadily.

Pasture competitions became a very notable feature of the Federated Farmers branch activities all over Taranaki before the Second World War and these have undoubtedly had a marked effect on the standard of pasture management in the district.

Farm Machinery

Since the Second World War the introduction to dairy farms of farm machinery on a large scale has had a marked effect on dairy farm management. Tractors are almost universal and because tractors and tractor equipment are widely used, the area under cultivation has again increased and paddocks are being ploughed largely for the purpose of levelling them and making them suitable for use of tractor equipment.

The use of the buckrake for silage making has followed the introduction of tractors, and whereas a few years ago the grab-stacker was a piece of harvesting equipment seen on almost every farm, today it is almost a museum piece. Though the buckrake may not result in silage being harvested more quickly than before, it does reduce the labour force and therefore increases the efficiency of silage making.

Haymaking is now generally done by contractors using hay balers and though these machines are not ideal on rolling country, they have also reduced the labour required for harvesting very considerably.

Herd Improvement

Herd improvement as a means of increasing the efficiency of dairy production has received great attention in Taranaki, especially in the past 20 to 30 years.

A Government herd testing group was started in Taranaki in 1910, but it is from the inception of group herd testing in 1924 that the emphasis on herd improvement has been laid. The average production of tested cows has been steadily rising and except for the 1953-54 season the production per cow has been over 300 lb. of butterfat for the past 9 seasons.

Artificial breeding was introduced in 1949-50, when one group was operated; in the 1956-57 season there were 16 groups with 18,146 cows inseminated and with 76.3 per cent. of the cows in calf. This service, following the New Zealand Dairy Board's very valuable work in sire selection, has played an important part in herd improvement in Taranaki.

INCREASING PRODUCTION

There is no doubt that production from the dairying lands of Taranaki can be increased considerably.

On the high-producing farms great attention has been paid to pasture management. Close subdivision with regular rotational grazing, the making of plenty of silage and hay, the topping of all paddocks in late spring which are getting away to roughage, and the provision of as much autumn-saved grass as possible for cows when they come in in early spring have paid as good dividends there as in other districts.

The best farms are those on which the system of good management described above has been combined with a policy of ploughing up old pastures and sowing to new grass. However, many dairy farmers still carry out rotational grazing only during spring and cut about half as much for hay and silage as they could cut. Very few farmers have a regular plough-and-resow policy.

There are several reasons for many Taranaki farmers not making greater use of the latest methods of management. The country is very broken by creeks and streams and a systematic farm layout is difficult to arrange. This has meant that separate night and day paddocks are almost impossible to avoid and that paddocks at the back of the farm have been cut year after year for hay. The fact that only limited areas are suitable for cutting has also resulted in the same paddocks being cut often, with consequent poor yields and poor-quality hay.

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Many have been discouraged from ploughing up old pastures because of the fear that weed seeds lying dormant in the ground would germinate and reinfest the paddock.

The ideal conditions for grass growth in Taranaki have had some effect on the policy adopted by the farmers. Even fairly poor, weedy pastures will produce reasonably well in a district where grass will grow all the year round, and some farmers are content with their position without making any extra effort to produce more. However, progressive farmers have been able to work out systems whereby they can practise modified rotational grazing even on the roughest and most broken country. By using bulldozers they have filled in creeks and hollows and made almost flat paddocks out of those previously impossible to work with implements.

The weed problem is a real one, but with adequate topdressing, together with the use of weedkiller, good pastures can be established.

Cropping has become less and less important as the development of the country has proceeded and there is no doubt that the less the land is cropped the easier it is to get a good establishment of grass. In fact many of the best pastures have been established straight from old grass which has been ploughed, worked up, and resown without any crop in between. This grass-to-grass system of pasture renewal is one which should be developed more fully in Taranaki, a district so well suited to pasture production.

Pasture Types and Seed Mixtures

As in most dairying districts the more highly productive pastures contain perennial ryegrass, short-rotation or Italian ryegrass, cocksfoot, and red and white clover.

The results with short-rotation ryegrass in Taranaki have not been entirely satisfactory. It requires two essentials for successful establishment and maintenance—high fertility and spells of at least 14 days between grazing. In addition it needs to be able to continue growth throughout summer. In a very dry summer or early autumn short-rotation ryegrass pastures have thinned out considerably. It has also been found that in hot, humid weather, which is common in coastal Taranaki, there has been considerable death of short-rotation ryegrass through attack from a fungous disease of the roots.

Where conditions are favourable the production of short-rotation ryegrass is very high, however, and farmers are now prepared to overdrill paddocks annually with light sowings of this grass to maintain their production.

Cocksfoot has its opponents in Taranaki just as it has its advocates, but in the milder parts of the district it grows well and produces a good bulk of feed in summer and autumn.

To facilitate the easier working of their farms some farmers have filled in gullies by the use of heavy equipment.

White clover is not difficult to maintain if phosphate and especially potash are applied liberally and though it is the mainstay of pastures at all seasons, both Montgomery red clover and cowgrass have proved their value for autumn feed, especially in the first 2 seasons of the pasture.

Prairie grass has been sown by a few farmers for many years and it has proved a valuable species for special-purpose pastures, providing feed in late autumn, winter, and early spring. Even with short-rotation ryegrass to supply feed for the same periods prairie grass is still considered worth while by those farmers who have grown both successfully.

Seed mixtures generally recommended and widely used in Taranaki consist of:

Dairy Pasture Used Only for Day Grazing

	lb. per acre
Certified perennial ryegrass	20
Certified short-rotation ryegrass	10
Certified cocksfoot	4 to 6
Certified white clover	2
Certified cowgrass	2
	38 to 40

Timothy is included in mixtures in inland parts of the district and cocksfoot is reduced to 4 lb. per acre. There is no evidence to show that more than 40 lb. of seed per acre is necessary for a mixture containing the above species.

Dairy Pasture Used for Day and Night Grazing

	lb. per acre
Certified perennial ryegrass	15
Certified short-rotation ryegrass	15
Certified white clover	2
Certified cowgrass	2
	34

Cocksfoot at the rate of 3 to 4 lb. per acre may be added, especially on coastal land likely to dry out in summer.

Special-purpose Mixture Containing Prairie Grass

	lb. per acre
Prairie grass	35
Certified short-rotation ryegrass	10
Certified white clover	2
Certified cowgrass	2
	49

Cocksfoot may also be included in this mixture if desired.

Another special-purpose pasture mixture suitable for Taranaki is:

	lb. per acre
Certified short-rotation ryegrass	20
Certified cocksfoot	6
Certified white clover	2
Certified cowgrass	2
	30

Inland, where it is colder, cocksfoot may be left out of the mixture. There does not appear to be any necessity

to include more than 2 lb. of any of the clovers, as experience has shown that provided phosphate and potash are applied in ample quantity, a very vigorous clover growth is assured.

The use of these mixtures accentuates the need for good pasture management. Such pasture should always be given plenty of spell between grazing and should be grazed down as quickly as possible. To get the best results from all the species sown the pasture should be spelled to give each the chance to grow its maximum bulk of feed. For example, winter spelling will allow full production from short-rotation ryegrass, and spelling about the beginning of January will produce the maximum bulk of feed from cocksfoot and cowgrass.

Good pastures can be established in Taranaki without difficulty provided the requisites of consolidation and fertility are met, but the value of good management of the established pasture should never be overlooked. It is of little value to go to the trouble of sowing new grass if it is not properly grazed throughout its lifetime; pastures are often renewed and then all the gates on the farm are left open and the new grass is grazed along with the rest.

Management, involving the regular spelling of pastures, is the most important single factor in pasture production, more important even than topdressing, and therefore pasture renewal should always be accompanied by the introduction of the system of rotational grazing if this is not already carried out.

Surface Sowing

Surface sowing as a means of pasture renovation has always been adopted quite widely in Taranaki. On some farms where a good layout has been adopted and extra fertiliser applied fair results have sometimes followed, but they have often been disappointing.

Results from the introduction of new techniques of applying seed to established pastures have indicated that overdrilling will no doubt become a valuable method of maintaining the ryegrass content of dairying pastures, especially when the pasture has been opened up by stock in a wet winter or early spring.

Though results of autumn sowing are probably better than spring sowing, the results of spring sowing of paddocks badly pugged during winter have been very good. When the paddock is uneven, however, ploughing and cultivating allow far better opportunities for levelling, and if the pasture is very matted with browntop or Yorkshire fog, ploughing is preferable to surface sowing.

Radio Broadcasts for Farmers

RADIO broadcasts for farmers will be given during May as follows:

1YA Auckland, 7.45 p.m.

7 May—Talk by officer of Animal Industry Division, Department of Agriculture, Auckland.

14 May—"Mechanical Drain Cleaning", by D. F. Scott, Machinery Instructor, Department of Agriculture, Auckland.

21 May—Talk by officer of Animal Industry Division, Department of Agriculture, Auckland.

28 May—"Winter Soil Conservation Work", by D. W. McLachlan, District Soil Conservator, Department of Agriculture, Auckland.

1XH Hamilton, 12.33 p.m.

12 May—"The Scourge of Hydatids", by G. R. Mackintosh, Livestock Instructor, Department of Agriculture, Hamilton.

19 May—"Farm Shelter", by J. R. Murray, Instructor in Agriculture, Department of Agriculture, Hamilton.

26 May—"The Farmers' Relationship to the Community", by R. H. Wynyard, Federated Farmers, Hamilton.

1YZ Rotorua, 7.15 p.m.

14 May—"Young Farmers' Clubs", by district committee of Tauranga Y.F.C.

28 May—"Tanker Collection of Milk", by L. E. Downs, Special Inspector, Department of Agriculture, Rotorua.

2XG Gisborne, 8 p.m.

13 May—Talk by J. D. Overbye, Horticultural Instructor, Department of Agriculture, Gisborne.

20 May—Talk by E. B. Smythe, Livestock Instructor, Department of Agriculture, Gisborne.

2YZ Napier, 7.10 p.m.

6 May—"Soil Structure and Fertility", by G. M. Bennett, Instructor in Agriculture, Department of Agriculture, Hastings.

20 May—"Handling the Wool Clip", by R. W. Scaife, Sheep and Wool Instructor, Department of Agriculture, Hastings.

2ZA Palmerston North, 12.33 p.m.

5 May—"Management of Sheep", by R. Gill, Livestock Instructor, Department of Agriculture, Levin.

12 May—"Weed Control by Pasture Competition", by D. I. Glue, Instructor in Agriculture, Department of Agriculture, Wellington.

19 May—"Watering Glasshouse Tomatoes", by G. N. Paulin, Horticultural Instructor, Department of Agriculture, Palmerston North.

26 May—"Chemical Testing of Seeds for Germination", by A. Y. Lithgow, Officer in Charge, Department of Agriculture Seed-testing Station, Palmerston North.

2XA Wanganui, 8 p.m.

1 May—"For the Country Woman", by Mary MacDonald.

8 May—"The Radio Vet.", by S. Jamieson, Veterinarian, Department of Agriculture, Wanganui.

15 May—Talk by C. M. Bailey, Supervisor, Taranaki District Pig Council.

22 May—"Preparing for the Chick Season", by B. J. Russell, Poultry Instructor, Department of Agriculture, Wanganui.

29 May—"Some Local Weed Problems", by G. R. Moss, Instructor in Agriculture, Department of Agriculture, Wanganui.

3YA Christchurch, 12.20 p.m.

5 May—"Selection of Shrubs for the Home Garden", by K. H. Marcussen, Horticulturist, Department of Agriculture, Christchurch.

19 May—Review of "The New Zealand Journal of Agriculture", by E. G. Smith, Instructor in Agriculture, Department of Agriculture, Rangiora.

4YA Dunedin and 4YZ Invercargill, 12.33 p.m.

5 May—"Y.F.C. in Otago and Southland", by H. A. Duff, Fields Instructor, Department of Agriculture, Dunedin.

12 May—"Cooperative Field Trials", by A. Stuart, Assistant Fields Superintendent, Department of Agriculture, Dunedin.

19 May—"Designing a Woolshed", by W. F. Dick, Sheep and Wool Instructor, Department of Agriculture, Invercargill.

26 May—"Farm Economics", by N. R. Woods, Farm Economist, Department of Agriculture, Dunedin.

4YZ Invercargill (following joint programme from 4YA and 4YZ)

5 May—"Lucerne Varieties", by J. Thomson, Instructor in Agriculture, Department of Agriculture, Invercargill.

Regular Sessions

1XH Hamilton, Mondays at 12.33 p.m. and Tuesdays at 8 p.m. (Frankton stock market report), Wednesdays at 12.33 p.m. (report from Ruakura Animal Research Station), Thursdays at 12.33 p.m., Fridays at 8 p.m. (stock sale review).

1XN Whangarei, Mondays at 8 p.m. (Northland livestock report and "Farming for Profit"), Wednesdays at 8 p.m. ("Farming for Profit"), and Fridays at 8 p.m.

1YA Auckland, Mondays at 12.33 p.m., Tuesdays, Wednesdays, and Thursdays at 7.45 p.m., and Fridays at 6 p.m. and 7.45 p.m.

1YZ Rotorua, Mondays at 12.33 p.m. (Waikato stock market review), Tuesdays at 7 p.m. (Hamilton stock market report), Wednesdays at 7.15 p.m. (Pig Council talk on fourth Wednesday of every other month at 12.33 p.m.), Thursdays at 12.33 p.m.

2XA Wanganui, Wednesdays at 8 p.m. (stock sale report), Thursdays at 8 p.m.

2XG Gisborne, Tuesdays at 8 p.m., Fridays at 8.2 p.m. (Gisborne stock market report).

2XN Nelson, Thursdays at 8 p.m.

2XP New Plymouth, Thursdays at 8.1 p.m.

2YA Wellington, Mondays at 7.15 p.m., Thursdays at 12.33 p.m., Fridays at 7 p.m. (Feilding stock market report).

2YZ Napier, Tuesdays at 12.12 p.m. (Hawke's Bay orchardist session), Tuesdays at 7.10 p.m., Wednesdays at 7.15 p.m. (Hawke's Bay-Poverty Bay livestock market report), Thursdays at 12.33 p.m.

2ZA Palmerston North, Mondays at 12.33 p.m., Fridays at 8.45 p.m. (Feilding stock market report).

3XC Timaru, Mondays at 8 p.m. (Pleasant Point stock market report), Tuesdays (fortnightly) at 8 p.m. (Temuka stock market report), Wednesdays at 8 p.m., and Saturdays at 10.30 a.m.

3YA Christchurch, Mondays at 12.20 p.m., Wednesdays at 7.15 p.m. (Addington stock market report), Thursdays at 12.33 p.m. and 7.15 p.m.

3YZ Greymouth, Mondays and Thursdays at 12.33 p.m.

4YA Dunedin, Mondays at 12.33 p.m., Tuesdays at 12.33 p.m., Wednesdays at 12.33 p.m. and 6.50 p.m. (Burnside stock market report), Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.33 p.m., Tuesdays at 12.33 p.m. and 7.15 p.m. (Lorneville and Gore stock market reports), Wednesdays at 12.33 p.m., Thursdays at 12.33 p.m.

The Home Garden in May

By A. G. KENNELLY,
Horticultural Instructor,
Department of Agriculture, Dunedin

LITTLE is to be gained in most gardens in May by sowing or planting any but the hardiest vegetables, as usually the weather can be expected to become less favourable for growth until the shortest day. Such jobs as tidying, composting, keeping down weeds, sowing broad beans, and setting out cabbage and hardy cauliflower for spring use constitute the principal work in most home gardens.

IT is not usually advisable to plant or sow even hardy subjects in cold situations where the aspect is unfavourable and where the soil is heavy and poorly drained. Where planting and sowing have to be done in May, the soil should be well drained and cultivated. If firming is necessary in the preparation of the seed-bed, it should be confined to the seed or plant rows and done only in moderation on medium and heavy soils. A simple and usually effective method of testing soil condition for sowing is to walk on it. If it sticks to the soles of the boots, it is too wet.

Cabbage, silver beet, and spinach can still be set out in most gardens and, where conditions are not likely to be too severe, lettuce and cauliflower as well. Broad beans and spinach can be sown in most gardens and in some districts peas, but unless the garden is in a favourable situation and the weather likely to be good, it is best to defer sowing seeds of such plants as carrots, onions, turnips, and even radish until July or later.

The top growth of asparagus should be cut down as soon as it begins to turn yellow and the digging of kumaras and, in most situations, potatoes should be completed without delay. Potatoes and other root crops in store should be sorted over to remove those with rots. Rhubarb beds should be weeded and the seed stalks removed.

If the garden is tidy, it can be quite attractive in winter, even to those who are not gardeners. The cleaning out of untidy corners and the removal of such trash as old boxes and pieces of wood, stakes, bricks, and stones not only improve the appearance of a garden, but have an important bearing on pest and disease control. Untidy corners provide ideal breeding grounds for such garden pests as earwigs, cutworms, millepedes, slaters, snails, slugs, and wireworms.

[*Sparrow*

Cover Crops

Whenever practicable ground should be sown with a cover crop for digging in to increase the organic material in the soil. Cover crops also take up soluble plant foods and so prevent their loss by leaching. Choice of crop depends largely on the district or the period the ground is likely to be left before it is required for another vegetable crop.

Barley and oats are quick maturing and usually grow quite well even in the colder southern districts if sown now. Mustard is even quicker where it is warm and in favourable conditions it usually produces a heavier crop, but it usually fails to grow well where conditions are cold.

Lupins make the best cover crop for digging in on most soils, as they are a legume and are a rich source of nitrogen when the nodules on their roots break down. They are subject to frost damage if sown very early for overwintering in districts subject to heavy frosts, and if sown late in the colder districts they usually fail to make adequate growth before they are required for digging in.

The seed-bed for a cover crop should be firm and reasonably moist and for best results the seed should be gently raked in. Thick sowing is desirable with most green crops, as a thick stand of plants is required to increase the total amount of dry matter to be dug in, especially as the period between sowing and digging in is usually limited.

Money spent on fertilisers for a green crop is rarely wasted. The extra plant food applied will increase the

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FARM AND HOME DIVISION, BUSH HOUSE, LONDON, W.C.2

[*Green and Hahn*

Green crops such as lupins (left) or oats (right) are useful for soil improvement and should be sown whenever land is likely to be vacant long enough to enable them to develop good leafage.

organic matter in the green crop, but it will not be "wasted" on the green crop as is thought by some gardeners. It will be absorbed and held by it and gradually made available to the succeeding crop as the green crop rots down. The nearer to maturity a green crop is permitted to grow the greater will be the amount of organic matter available.

Broad Beans

May is usually the preferred month for sowing broad beans, as they are very hardy and do well in cool conditions. As broad beans are easy to grow and most varieties can be relied on to produce a good crop with very little attention, they deserve a place in the garden of every home where their flavour is appreciated. The earlier sowings usually mature at a time when vegetables are scarce and lacking in variety in most gardens.

Broad beans do not require special soil, but it is not advisable to sow them in wet, sticky soil or light soil that tends to dry out. They do well in fairly heavy, moist, well-drained soils that have been thoroughly cultivated and into which has been worked, if the soil lacks organic matter, a moderate amount of material such as compost or well rotted farmyard manure.

The principal plant nutrient required on most soils is phosphoric acid, which can be supplied by superphosphate or bone manure, though on soils such as those in many home gardens that have been cultivated for many years without a balanced manurial programme being followed, a complete fertiliser containing nitrogen, phosphorus, and potash is likely to give best results. Apart from their nutrient value phosphates are said to have a stimulating effect on the bacteria on the nodules of the roots of broad beans which help to keep the plants supplied with nitrogen.

Broad beans require only a small amount of nitrogen. A mixture of 1 part of sulphate of ammonia, 4 parts of superphosphate, and 1 part of sulphate or muriate of potash, all by weight, or alternatively 3 parts of blood and bone, 2 parts of superphosphate, and 1 part of sulphate or muriate of potash, worked in at 2 oz. to 3 oz. to the square yard according to the fertility of the soil, is likely to give good results on most soils that have been well dressed with balanced fertilisers for previous crops.

Though broad beans are tolerant of a fairly wide range of acidity or alkalinity, they will not thrive in excessively acid conditions. In districts with moderate or heavy rainfall growth in most soils not recently limed will be improved by applying carbonate of lime at about 2 oz. to 4 oz. to the square yard. It is best worked in some time before sowing.

Apart from weed control, beans should require little attention when young, but it is usually advisable in winter or early spring when the weather is boisterous to draw a little soil against the stems of autumn-sown plants to support them. Tall varieties can be stopped when they are about 30 in. to 36 in. high by pinching out the tops. This encourages the plants to develop sturdy growth and is often sufficient to check an attack of black aphids in its early stages, particularly if the aphids' natural enemies, such as lacewing flies, ladybirds, and their larvae, are numerous.

In many gardens where tall varieties are grown it is advisable to support the plants as they develop or as they become heavy with pods. One or more strings run along the sides of rows and tied to stakes at intervals of 5 ft. to 6 ft. will save the plants from being blown over.

Sowing

Beans sown early in autumn do not necessarily yield pods earlier than those sown in late autumn or early winter, because though the plants may make good growth in late autumn and early winter, they are likely, particularly where winters are fairly severe, to be damaged and checked by disease or by boisterous weather. The earliest flowers often fail to set because they are produced at a time of unfavour-

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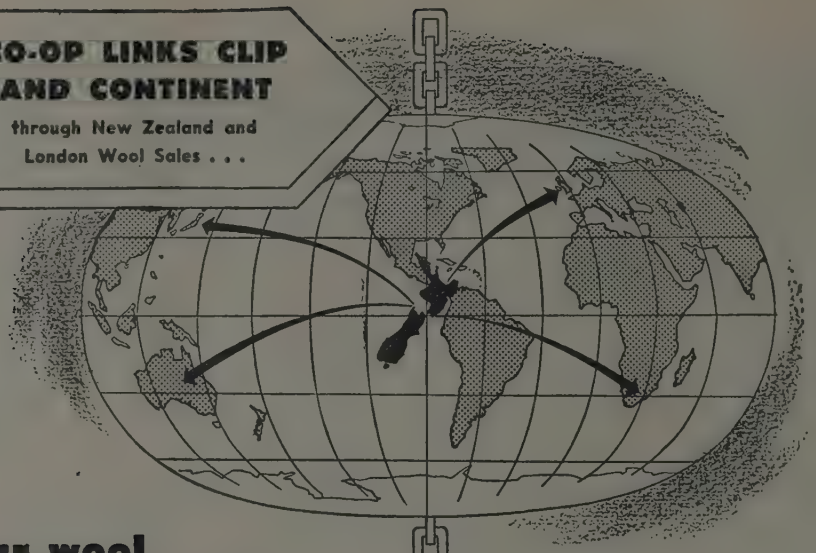

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In situations exposed to strong winds broccoli (winter cauliflower) can be supported as shown if earthing up along the rows is not practicable.

able conditions and sudden extreme temperature changes, but spring sowing should not be delayed too long, as the crop is liable to be reduced if it matures in the hot, dry conditions of summer.

In deep, well drained soil broad beans are best set 2 in. to 3 in. deep, preferably with a trowel, and 4 in. to 6 in. apart. They may also be sown in the bottom of a drill about 3 in. deep. Seed can be planted in double rows 10 in. to 12 in. apart, with each double row not less than 26 in. apart. If single rows are preferred, they should be 15 in. to 18 in. apart. Germination is usually good, but a few extra seeds can be sown at the ends of rows and seedlings later transplanted to fill gaps; young plants should be transplanted as early as possible.

Seed varies in size, but a little less than a quart of seed will sow about 50 ft. of double row. Germination can usually be speeded by soaking the seed for about 12 hours before sowing. Seed dusts give some protection to newly sown seed against soil-borne disease.

Varieties

Two main varieties of broad beans are grown in New Zealand, the broad-podded or Windsor type and the long-podded type. The broad-podded type has relatively short, broad pods usually containing about 3 to 5 large seeds. It is represented by varieties such as Broad Windsor, Giant Windsor, and Harlington Windsor. Early Long Pod and Mammoth Pod are examples of the long-podded type, varieties of which may produce pods up to 16 in. long, though usually they are about 5 in. to 9in. long and contain about 4 to 7 seeds. The Windsor type is usually considered to be of superior flavour, but the long-podded beans are hardier and yield more heavily.

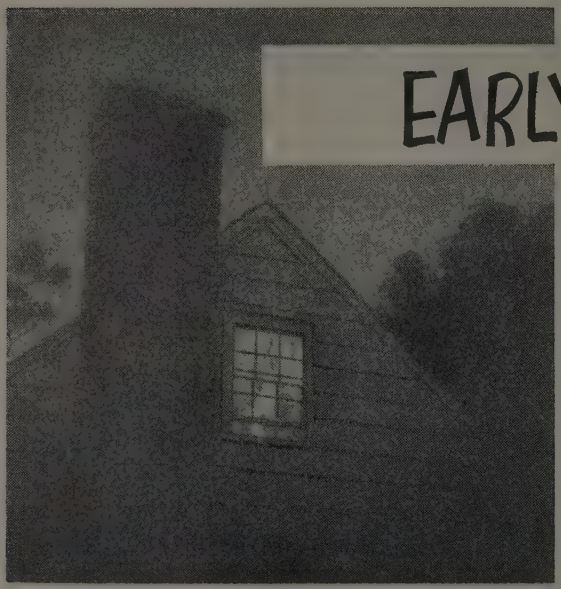
Dwarf varieties of broad beans are also sold by some seedsmen. They are well worth growing in small gardens or in exposed situations and they are also useful for sowing in January where conditions are not too hot and dry (or even in February where the growing period is long enough) to mature before winter. The pods contain 2 to about 4 small seeds, and are usually attached in fan form. The foliage is small and often fairly dark. Examples of the type are Coles Early Dwarf and Dwarf Gem.

Lettuce

Growth of lettuce is slow in most districts in May and the plants should be kept weed free, but the soil between the rows should not be compacted excessively by treading on it. When plants are being set out a sheltered site with a northerly aspect where the soil has been well cultivated and manured is desirable. If drainage is poor or the ground likely to be rather cold, young plants should be set out on a raised bed.

Like most salad crops lettuce should be grown quickly and at this time of the year, when in most districts conditions are not good for growth, a light, sandy loam rich in well rotted organic matter such as farmyard manure or compost is desirable for growing plants in or setting them out into.

Neapolitan Winter, Imperial 615, Imperial D, Imperial 101, and Triumph are good varieties for setting out in May.



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MARATHON GUMBOOTS *by Skellerup*

Sturdy, well rooted cabbage or cauliflower seedlings can still be set out in favourable situations where the soil is well drained.

Peas

Garden peas are hardy and yields are usually higher and the quality better when the crop matures under comparatively cool conditions, but heavy frost is liable to affect the setting of the flowers, and frost following a mild period during which soft growth has developed may damage the haulms. In districts where winters are severe autumn sowing should be made sufficiently early to enable the young plants to become established, but not so early that they make soft growth. Losses from autumn sowing may be serious in severe weather, but in well drained soils in districts where winters are not hard autumn sowing is usually satisfactory.

In many districts, however, autumn-sown crops mature little ahead of crops sown in favourable conditions in spring. For autumn and spring sowings seed should be dressed with a suitable seed protectant. The peas should be shaken for several minutes in a tin containing enough of the chemical to coat the seed. Afterward excess should be removed by tapping the tin sharply so that the powder falls to the bottom.

Pea seeds germinate and the plants make vigorous growth at temperatures considerably lower than those suitable for many other vegetables.

Sowing

Seed should be sown 1 in. to 2 in. apart in V-shaped or broad, flat drills, which can be drawn out with the hoe 18 in. to 36 in. apart according to variety. Drills should be 2 in. to 3 in. deep, except where conditions are hot and dry, when they should be considerably deeper, so that though the seed should not be covered with more than 1½ in. to 2 in. of soil, the roots will be well down in the cooler and moister levels.

The seed-bed should be thoroughly cultivated, as a fine, well prepared seed-bed has an important influence on the promotion of even, full germination and uniform maturity at harvest.

Protection of newly emerged peas against birds is essential in some districts, though birds are troublesome mainly in early spring when food is short. Pea guards made of wire netting are effective if the ends are blocked, but they should be moved before the peas become entangled in the wire. Cotton stretched over the shoots is also effective if a number of strands, which may be criss-crossed or placed in parallel lines, are used.

Manuring

Peas, though they fix nitrogen and improve the physical nature of most soils, are an exhausting crop, because they have high demands for plant foods. For this reason and because the period between sowing and harvesting of most varieties is comparatively short, the soil should be well cultivated to enable the roots to spread freely and gather rapidly the nutrients needed by the plants.

Crop failures are often due to poor drainage and sometimes to inadequate liming, though liming should not be too heavy, as a neutral or slightly acid soil suits pea crops. An annual dressing of 3 oz. to 4 oz. of lime per square yard is usually satisfactory, though heavier dressings may be needed in high-rainfall districts.

On soils of high fertility, such as some virgin soils or those that have been heavily dressed with organic manure for a previous crop, fertiliser applications need not be heavy. A dressing of superphosphate applied at about 1 oz. to 2 oz. per square yard may be sufficient, but on most well worked garden soils a complete fertiliser (such as a mixture containing 2 oz. of sulphate of ammonia, 6 oz. of superphosphate, and 1 oz. of sulphate or muriate of potash) at 1 oz. to 2 oz. per square yard gives good results. Peas are highly sensitive to fertiliser injury and care should be taken when applying the mixture so that it does not come in contact with the seed.

Varieties

Popular varieties of peas for autumn sowing for early spring cropping include William Massey and Little Marvel.

Potatoes

Potatoes rival tomatoes in the number of diseases they are subject to. Most home gardeners find it difficult

[*Sparrow*

Varieties of spinach are available with either savoy-type (crumpled) leaves (left) or smooth leaves (right).

to identify more than a few of the commoner diseases, though tubers being dug at this time of the year are liable to be infected with one or more of several diseases. One of the commonest is common potato blight (late blight or Irish blight).

Tubers become infected either in the soil through spores washed from the diseased tops or in harvesting through contact with blighted foliage. When common potato blight tuber rot develops in the soil it is primarily brown and spreads irregularly from the surface through the flesh rather like a brown stain. The diseased area usually becomes soft, partly because of the presence of considerable moisture, but mainly because other organisms causing soft rot such as bacteria usually follow the entry of common blight.

In store the disease is usually a typical dry rot with irregular sunken patches, but in conditions of high humidity and moisture which favour its development the disease may spread and affect the whole tuber.

The infected area usually remains firm and often has a metallic tinge, especially at the edges of healthy tissue.

Potato scab is another disease commonly found in tubers during digging. There are two types of scab which do not differ greatly in appearance, though powdery scab may develop a canker, which is much more serious. Usually, scab shows as scabby spots varying in appearance from roughened, shallow depressions to corky protrusions. Barriers of cork are laid down by the tuber in an effort to exclude the scab-producing organisms. Reduction in yield may amount to 10 per cent.

Control consists of avoiding soils which have recently been heavily limed or to which heavy dressings of organic manure have recently been applied; heavy dressings of organic matter applied the previous year so that they are thoroughly decomposed are satisfactory. Very acid soils inhibit the development of the parasite, but apart from soil acidity the development of potato scab is influenced by soil moisture and temperature. Its development is usually favoured by conditions where soil moisture is slightly below the optimum requirements for growth. A corrosive sublimate steep is of some value in treating tubers attacked by common scab, but is less satisfactory against powdery scab.

Spinach

Spinach is one of the few vegetables that can be sown in May, even in the colder districts, though the soil must be well drained. In favourable conditions spinach is quick growing, maturing in from about 40 to 55 days.

Spinach is hardy when established under cool conditions and can be sown throughout winter in well drained and well cultivated soil that is not too heavy, provided the seedlings can establish themselves without being "lifted" by frost. It will grow at temperatures only slightly above freezing, though the optimum growth temperature is somewhat higher. Though seed germinates at relatively low temperatures (40 degrees F. or even lower), seedling emergence is usually delayed where there is frequent heavy rain. Germination is good at 50 to 60 degrees F., but the percentage decreases at higher temperatures.

Spinach thrives in cool conditions on a great range of moist, fertile, well cultivated, and well drained soils. It is not tolerant of a high degree of soil acidity and lime should be applied to most soils that have not been recently dressed, though too much lime may cause yellowing of the leaves because of a deficiency or unbalance of certain essential elements, such as manganese or iron.

Fertilisers

A good dressing of organic material such as well rotted farmyard manure or compost is advisable on most garden soils, and as spinach is a leafy vegetable, extra applications of nitrogen may be supplied by liquid manure or a side dressing of nitrate of soda or sulphate of ammonia raked in along the line of the row, but it should not touch the foliage. Liquid manure is preferable where conditions are inclined to be dry, as abundant moisture is essential for high yields and good quality; growth should be reasonably quick, as otherwise some varieties tend to be tough.

Seed should be sown thinly ½ in. to 1 in. deep in rows 12 in. apart. Plants can be thinned to four or five to 1 ft. of row, though if seed is sown thinly, thinning in the accepted sense is not essential unless conditions are dry or the soil is very poor; it can be confined to the removal of the young plants when large enough for use. In poor soil or in dry conditions crops that have been given generous spacing in the seedling stage usually "stand" much longer.

Varieties

Varieties of spinach are available with either smooth or savoy-type (crumpled) leaves, but spinach is usually sold as either prickly seeded or round seeded.

Prickly seeded spinach is usually sold for winter use, as it is generally considered to be hardier than the round. Because it is considered by many to be long standing, it is also very popular for summer use. This belief in the superiority of prickly seeded spinach is not supported by the evidence of trials of different varieties of the two kinds. It has been demonstrated that there are long- and short-standing varieties of both round and prickly seeded spinach; either may be smooth or savoy leafed.

The virus disease mosaic sometimes causes reduction in yield, and resistant varieties have been developed overseas, though they do not appear to be available in New Zealand. Good varieties available locally include Hybrid No. 7, Prickly Supreme, and Prickly Winter Long-standing.

Feeding of Concentrates to Dairy Cattle

EXPERIMENTS at the Department of Agriculture's Ruakura Animal Research Station to investigate whether, or under what circumstances, feeding of concentrates to dairy cattle would be payable are described in this article, which is adapted from a paper given at the 1957 Ruakura Farmers' Conference Week by L. R. Wallace, Senior Principal Scientific Officer at Ruakura. The chief conclusion is that concentrate feeding should be practised only in emergency periods; it should not be used to make good feed shortages that can be rectified by better management.

MANY experiments have shown that, if used entirely for milk production, from 4 lb. to 6 lb. of concentrates, depending on their quality, are required for the production of a gallon of milk and from 9 lb. to 13 lb. for the production of 1 lb. of butterfat. On this basis, with concentrates at 4d. per lb. equivalent to £33 6s. 8d. per ton, the feed cost of a gallon of milk would be about 1s. 4d. to 2s. and that of 1 lb. of butterfat from 3s. to 4s. 4d. It is clear that even with 100 per cent. utilisation for milk production, the additional production immediately obtained from feeding concentrates is rarely likely to pay for the cost of the material fed, let alone the labour costs involved, and this is particularly so for the farmer on ordinary factory supply.

In practice the prospect of obtaining immediately profitable returns is even more remote than is suggested by these calculations. As most dairy farmers know quite a lot of feed is needed to maintain a dry dairy cow at constant bodyweight. A cow in milk has this same substantial body maintenance requirement, and indeed usually considerably more than half the nutrients eaten are used for maintenance, and some may be used for growth, for laying on condition, or for supporting pregnancy. Only a fraction of the total consumption—a fraction which diminishes as lactation advances—is actually used for milk production.

Thus, though nutrients equivalent to those contained in 4 lb. to 6 lb. of concentrates are required for the production of each extra gallon of milk, this certainly does not mean that an extra gallon of milk will be obtained from each 4 lb. to 6 lb. of concentrates fed. The amount of extra production will depend entirely on what proportion of the additional feed is used for milk production.

Limited Scope

As a general rule, therefore, payable responses from feeding concentrates can be obtained only if they are fed for limited periods with a view either to establishing high yields or preventing serious drops in production in the hope that a reasonably high proportion of the production advantage thus secured will persist after concentrate feeding has ceased.

It was with these considerations in mind that Ruakura started investigating concentrate feeding and decided to look first at the value of concentrates as a supplement fed to cows immediately after calving. On many farms feed is often critically short for some 6 to 8 weeks after calving, and there seemed a better chance of obtaining substantial carry-over effects from feeding meal at this than at any other stage of lactation.

Nature and Purpose of Trials

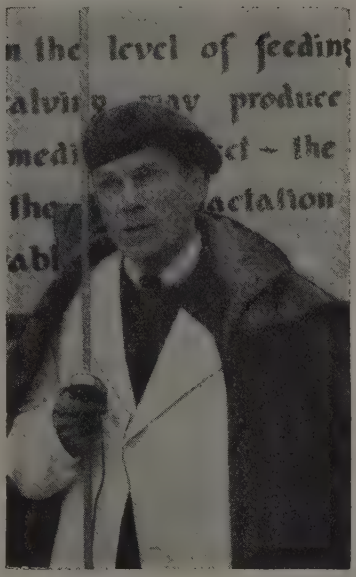
To date, two experiments have been conducted over 2 seasons. Except for one very important difference, the procedure followed was the same in both.

Each season 22 sets of twins were used. During the dry period before calving the cows were break grazed on autumn-saved pasture and care was taken to treat the two members of each twin pair in exactly the same way so that any differences in production after calving would not be due to differences in the way they were wintered.

After calving, both members of each twin pair were grazed together, but one member was fed concentrates for the first 8 weeks of her lactation, whereas the other was not. At the end of the eighth week the feeding of concentrates was stopped, and from then on the two members of each pair were again treated exactly alike (all the cows being rotationally grazed as a single group on good pastures which provided abundant feed) to find out the extent to which the production differences brought about by the meal feeding persisted during the rest of the season.

Mixture Fed

The same concentrate ration was fed in the two experiments. There was nothing remarkable about the mixture: It consisted of crushed oats (45 parts), barley meal (15 parts), coconut meal (20 parts), and bran (20 parts). In both experiments it was fed at the same rate, 3 lb. at the morning and evening milkings, a total of 6 lb. per cow per day, irrespective of level of production. The precaution was taken of accustoming the cows to the meal beforehand, and most of the animals readily ate their full ration right from the time of calving.



[*Niederer*

Dr. Wallace discussing feeding of concentrates at the Ruakura Farmers' Conference.

It must be emphasised again that in both experiments the only difference between the way the two groups of twin members was treated was that one group was fed concentrates for the first 8 weeks after calving, whereas the other was not. The important difference between the two experiments was this: In the first year the cows were deliberately grazed extremely hard during the first 8 weeks after calving, whereas in the second year every effort was made to provide an abundance of grass during this period. In both years ample pasture was provided for all animals after the end of the eighth week.

The first experiment served to illustrate the sort of result that might be expected from concentrate feeding on farms where reserves of hay, silage, and autumn-saved pasture have all been exhausted before calving and where feed is drastically short for a couple of months until the rate of pasture growth increases sufficiently to meet the requirements of the herd. In contrast to this, the second experiment served to show the extent to which concentrate feeding might increase production on well managed farms where it is possible to provide a high level of grass feeding right from the time of calving onward.

Amounts of Feed Eaten

In both experiments the two groups of co-twins ate about the same amount

of feed during the dry period. This was to be expected, as at this time they were grazed together. However, after calving in the first year the twins that were fed meal ate just as much grass (in fact, a little more) than their mates which received no meal and which were grazing the same pastures. It seems that even the meal-fed twins were definitely underfed and hungry at this time and ate all the grass they could get.

In the second year, when there was plenty of grass, the meal-fed twins ate less nutrients in the form of grass than their co-twins. Their total intake in the form of meal plus grass was certainly greater than that of their grass-fed mates, but it is quite obvious that some of the nutrients in the meal that they ate each day was used not to boost production but simply to replace the nutrients that they would otherwise have eaten in the form of grass.

Effect on Production

The average differences (in milk and butterfat) are given in Table 1:

TABLE 1—AVERAGE DIFFERENCES IN PRODUCTION

	1st experiment	2nd experiment
Milk (gals.)		
1st 8 weeks ..	40	15
Total lactation ..	148	42
Fat (lb.)		
1st 8 weeks ..	18	8
Total lactation ..	79	24

There are several points to be noted: Firstly, production differences due to meal feeding were very much greater in the first season when grass was in very short supply than in the second, when ample pasture was available.

However, the very large differences in the first year were due not so much to a high level of production on the part of the meal-fed twins as to the very low level of production of their co-twins. The cows that received plenty of grass but no meal in the second season actually produced at a higher level than the cows which were given meal but only a limited quantity of grass in the first season.

The second point is that in both years, in addition to the production difference induced in the first 8 weeks while the twins were being differently fed, there was a marked carry-over effect during the rest of lactation, when the cows were being fed in exactly the same way.

Thus, in the first season the total lactation difference was on average about four times as large, and in the second season three times as large, as the difference which appeared over the period during which the meal was fed.

This serves to emphasise a point which is very important, quite apart from the question of whether or not it pays to feed concentrates. Errors of feeding or management committed early in the lactation may cause only a slight and scarcely noticeable drop in production at the time. They may nevertheless be quite serious, for they are likely to affect the level of production throughout the whole of the remainder of lactation.

It is not always realised that the level of production of a cow at any particular stage depends not only on her breeding and the way that she is being fed at the time but on the way she has been managed and fed during every day that she has been in milk and also during her dry period before calving. Poor production at the end of lactation may be due to mistakes made shortly after calving.

The lactation curves of cows were quite instructive. In the first season the milk yield of the unsupplemented animals showed only a small increase for the first couple of weeks after calving, reached a maximum during the third week, and thereafter fell away sharply. The yield of the meal-fed animals, on the other hand, climbed steadily to reach a peak during the seventh week and by the end of the eighth they were producing nearly twice as much as their unsupplemented mates.

When the feeding of concentrates was stopped and the cows were transferred from poor to good grazing the level of production of the meal-fed animals dropped slightly, whereas that of their unsupplemented mates rose a little, but only for a couple of weeks. Thereafter the two groups of animals continued to produce at widely different levels throughout the rest of the season.

As already mentioned, the differences due to meal feeding were much smaller in the second season. However, the production of the meal-fed cows climbed to a higher peak, and though their production dropped somewhat when the concentrates were withdrawn, part of the production advantage was maintained throughout lactation. It seems probable that in this second year the total lactation differences might have been almost as great had meal feeding been discontinued at the end of the sixth instead of at the end of the eighth week, for by that time the maximum production difference between the two groups had already been established and the cattle were steadily gaining in weight.

Effect on Liveweight

Each year both groups of twins were of very similar weight 8 weeks before calving. They gained weight at the same rate during the dry period, and their average condition was much alike at calving. However, the effect of the meal feeding showed up very clearly in the weight changes that occurred after calving.

In each season both lots of twins lost weight for some weeks, but those that received meal did not lose weight as rapidly or for as long as their unsupplemented mates. This, of course, provides very good evidence that by no means all the meal fed was used for milk production; obviously part of it was used to prevent loss of condition.

As might be expected, the amount of weight lost after calving was considerably greater in the first year, when grass was in short supply, than in the second, when there was an abundance available. But even in the second year the cows, particularly those fed on grass alone, were not at first able to eat sufficient to meet their requirements; they had to draw quite heavily on body reserves.

This, of course, is why production must suffer, as experiments previously carried out both at Ruakura and Massey Agricultural College have shown that it in fact does suffer, if cows are allowed to become too thin in the dry period and have not adequate reserves when they calve.

Another interesting feature of the weight curves after calving was that once the cows started to put on weight those that were not fed concentrates gained weight more rapidly. This was particularly noticeable in the first experiment, where the meal feeding resulted in a big production difference. It seems that by the end of the sixth week, when they started to put on weight, the unsupplemented cows had already lost much of their lactational drive and had developed a very strong urge to replenish their sorely depleted body reserves, and they thereafter used a relatively high proportion of the nutrients they consumed for this purpose.

In Tables 2 and 3 an attempt has been made to arrive at a balance sheet on a per-cow basis. The costs of the concentrates fed have been calculated assuming them to cost 4d. per pound, or £33 6s. 8d. per ton. The extra milk and butterfat have been valued rather

TABLE 2—ECONOMICS OF MEAL FEEDING—MILK

	1st experiment £ s. d.	2nd experiment £ s. d.
Cost of concentrates fed ..	5 13 2	5 2 10
Value of extra milk		
1st 8 weeks ..	4 18 7	1 18 7
Total lactation .	18 10 1	5 14 9
Profit (P) or Loss (L)		
1st 8 weeks ..	14 7(L)	3 4 3(L)
Total lactation .	12 16 11(P)	11 11(P)
1 gall. milk at 2s. 6d. ..	1 ton concentrates at £33 6s. 8d. (4d. per lb.)	

TABLE 3—ECONOMICS OF MEAL FEEDING—BUTTERFAT

	1st experiment £ s. d.	2nd experiment £ s. d.
Cost of concentrates fed ..	5 13 2	5 2 10
Value of extra fat		
1st 8 weeks ..	3 9 2	1 5 6
Total lactation .	13 3 7	3 19 10
Profit (P) or Loss (L)		
1st 8 weeks ..	2 12 11(L)	3 17 4(L)
Total lactation .	7 10 5(P)	1 3 10(L)
1 lb. butterfat at 3s. 4d.	1 ton concentrate at £33 6s. 8d. (4d. per lb.)	

optimistically at 2s. 6d. per gallon and 3s. 4d. per pound respectively.

It is apparent that the extra production obtained during the concentrate-feeding period was not sufficient in either year to pay for the meal fed, there being a loss both for milk and for butterfat. However, with returns calculated on the basis of the increase in production over the whole lactation there was in the first year a substantial profit for both milk and fat, and in the second a definite loss for fat but a very small profit for milk.

Buying Concentrates

Several kinds of concentrate feeds are available, and these differ quite considerably in nutritive value. Table 4 shows the nutritive value of some of the more common ones.

TABLE 4—ENERGY AND PROTEIN CONTAINED IN 100 LB. OF FEEDSTUFFS

	Energy (lb. starch equivalent)	Digestible protein (lb.)
Maize	77	7.5
Coconut meal	74	15
Linseed cake	74	25
Barley	71	7
Wheat	71	9
Peas	69	18
Oats	60	7.5
Bran	40	10

In buying a concentrate, the first thing to be considered is the purpose for which it is to be used and the nature of the foods that are to be fed with it. Firms selling concentrates frequently lay considerable stress on the protein content, or if a low-protein mixture is being sold, they emphasise that this is just what is needed to balance protein-rich pasture. Where concentrates are being used in early spring as a supplement to pasture, or even during the summer dry period, the protein content of the concentrate mixture is of secondary importance. At both times the meal is probably being fed because other feeds are in short supply and the primary deficiency is one of energy.

Practical trials carried out at the Hannah Dairy Research Institute in Britain with spring-calved cows have failed to show any difference between starchy and protein-rich supplements in their effect on milk production, either in late summer and early autumn or at other times of the year. So that in buying concentrates the sensible thing is to buy on the basis of the cost per unit of energy value. This means that one can afford to pay quite a lot more per ton for feedstuffs such as maize, barley, and coconut meal than for oats, pollard, and bran.

In buying proprietary concentrates a farmer should try to obtain information on what the mixture consists of and form his own opinion of its value. A mixture should not be purchased simply because it contains small amounts of expensive materials, as these may be dear only because they are in short supply and not because they are particularly valuable nutritionally.

General Recommendations

It is quite clear that concentrate feeding should not be undertaken in the hope of obtaining immediately profitable returns. As a general rule concentrates should be fed only over short periods, usually times of emergency, when as a result either of forcing production up or of preventing it from falling there is a reasonable chance of later reaping the benefit of a substantial carry-over effect. There is a much better chance of obtaining these substantial carry-over effects if the concentrates are fed at an early rather than at a late stage of lactation.

Cattle that are being fed at a low level are likely to show a greater response to concentrate feeding than those already on a high plane of nutrition. If the level of nutrition is already high, only a small proportion of the additional nutrients is used for extra production, some being used either to prevent loss of or to lay on condition, and some simply to replace cheaper feedstuffs that would otherwise be eaten.

In general, too, greater responses can be expected when concentrates are used to supplement animals that are in low rather than in high condition. Animals that are really thin cannot sustain production by mobilising body reserves. They have to depend on the amount of feed they are getting at the time.

It is often recommended that concentrates should be fed only to the higher-producing cows in a herd. This may be sound advice if the concentrates are being used in a liberally fed herd, but it must not be forgotten that the profits come from the carry-over effects and that these arise not only from increased levels of production but also from increased lengths of lactation. In the Ruakura trials some of the largest differences in production were obtained with low-producing sets of twins simply because the meal-fed members continued to produce much longer than their unsupplemented mates.

There is insufficient knowledge from which to offer sound advice as to the amounts of concentrates that should be fed.

Considering first the amounts that should be given to cows already being liberally fed on other feedstuffs, it is clear that in the second Ruakura experiment the comparatively small increase in production did not pay for the substantial quantities of meal that were used. The fact that in this experiment the meal was to some extent displacing grass from the diet suggests that it might have been fed at a wastefully high level. More payable results might have been obtained had the meal been fed in smaller amounts and for a shorter period.

On the other hand there may be a case for feeding quite large quantities for a strictly limited period, say the first 2 or 3 weeks after calving when the cows are losing weight rapidly, in the dual hope that production will be quickly forced to a high level and that this advantage will be maintained after the feeding of concentrates has stopped. Though such questions can be answered only by further research, alternative feeding programmes using smaller quantities of meal cannot be expected to produce large production increases.

When concentrates are being fed as a supplement to cows that are short of feed, it must be remembered that there is nothing at all remarkable about concentrates. From the nutritional angle they are usually valuable only in so far as they contribute to the level of intake of the cow. During the first couple of months after calving an average Jersey cow requires about 25 lb. of dry matter per day. If she is really short of feed, it is quite stupid to imagine that the position can be put right by feeding a few ounces of concentrates each morning and evening. The quantities fed must be sufficiently large to make a useful contribution to her total diet.

Attendant Benefits

There are, of course, benefits to be derived from meal feeding quite apart from those associated with increased production. The practice results in a certain amount of fertility being brought on to the farm. It may give greater flexibility in management and perhaps enable a farmer to carry more stock. It may help to control bloat. It may result in more contented cows in the shed, a better let-down, and more efficient milking.

Undoubtedly, throughout the country there are many herds which are very poorly fed during the post-calving period. This, it might be argued, provides a strong case for the extended use of concentrates. Ruakura believes that the answer lies not in the greater use of concentrates, but in better farm management to ensure that the gap in feed supplies is filled with feedstuffs, such as grass and silage, that can be provided much more cheaply. Concentrate feeding should be practised only in emergency periods.

It is most regrettable that the large production difference obtained in the first experiment has already been used by some to prove that it pays to feed concentrates. What it really proves, of course, is that it does not pay to starve cows.

GELATINE DESSERTS

By CHRISTINE LYONS,
Home Science Instructor,
Department of Agriculture,
Auckland

Apricot souffle.

"WHAT can I make for pudding today?" is an all-year-round question, and though gelatine desserts are often associated with summer meals, there is no reason why they cannot be used at any time of the year. They are very good to serve after a heavier type of first course and, because they can be made in advance, they are excellent for dinner parties or for busy times when there are large numbers of people to be fed.

COLD souffles have a light and fluffy texture and a delicate flavour. They are made so that their appearance is similar to that of a cooked souffle—they should appear to have risen.

To achieve this effect, choose a straight-sided dish about 6 in. in diameter. Cut a piece of greaseproof paper, double or treble thickness, long enough to go round the dish and sufficiently deep to reach from the bottom to 3 in. above the top (see illustration on next page). Place the paper round the outside of the dish and pin the edges together. Pour the mixture into the dish, filling it 2 in. above the rim and leave to set. When the souffle is quite firm carefully remove the pins and take off the paper, using a knife that has been dipped in boiling water (see illustration on next page) Decorate the sides and the top as desired.

Apricot Souffle

4 eggs
½ pint of apricot puree (not too sweet)
½ pint of cream or unsweetened condensed milk
½ oz. of gelatine
¼ teaspoon of almond essence
1½ oz. of castor sugar
¼ cup of cold water

(6 to 8 servings)

Soak the gelatine in the water. Put the egg yolks, sugar, and apricot puree into a bowl and beat until light and fluffy. Add the gelatine mixture and then the almond essence. Stir lightly. Whip the cream or condensed milk and add to the mixture. Finally beat the egg whites until stiff and fold into the above mixture. Pour into the prepared souffle dish and when set decorate as desired with nuts or grated chocolate.

Marshmallow

This pudding sets very quickly and is delicious with stewed fruit.

1 tablespoon of gelatine
6 oz. of boiling water
½ teaspoon of cream of tartar
2 egg whites
4 oz. of cold water
Pinch of salt
4 oz. of sugar
Vanilla or almond essence

(6 servings)

Soak the gelatine in the cold water. Add the boiling water and stir until the gelatine is dissolved. Put aside to cool. Beat the egg whites, salt, and cream of tartar until stiff and then gradually beat in the sugar. When the gelatine is just beginning to set add slowly to the egg white mixture, beating thoroughly. Fold in the essence and put aside to set.

Ginger Supreme

1 tablespoon of gelatine
1 oz. of sugar
2 tablespoons of sugar
1 teaspoon of ground ginger
1 cup of milk
½ teaspoon of grated lemon peel
¼ cup of mixed, chopped crystallised ginger and crystallised cherries
¼ teaspoon of cinnamon
2 tablespoons of sherry
2 oz. of cold water
Pinch of salt
2 beaten egg yolks
2 egg whites
½ cup of whipped cream
1 tablespoon of icing sugar
Pinch of ground nutmeg

(6 servings)

Soak the gelatine in the cold water. Combine the 1 oz. of sugar, salt, ground ginger, egg yolks, and milk and cook over hot water until thick. Add to the gelatine and leave until starting to set round the edges. Beat egg whites until stiff and then beat in the 2 tablespoons of sugar. Fold into the gelatine mixture together with the cream. Combine the icing sugar, cinnamon, nutmeg, and fruit and add to the pudding with the sherry. Serve in individual glasses.

Lemon Delight

This is quickly made and requires no cooking.

1 dessertspoon of gelatine
Grated rind of 1 lemon
5 tablespoons of lemon juice
5 oz. of sugar
4 tablespoons of hot water
3 tablespoons of cold water
3 eggs, separated

Soak the gelatine in the cold water. Beat the egg yolks and sugar until light and creamy. Add the lemon rind and juice. Pour the hot water on to the gelatine and stir until dissolved; then combine with the lemon mixture. Whip the egg whites until stiff and then fold carefully into the above mixture. Set in individual dishes and decorate with whipped cream and chopped nuts.

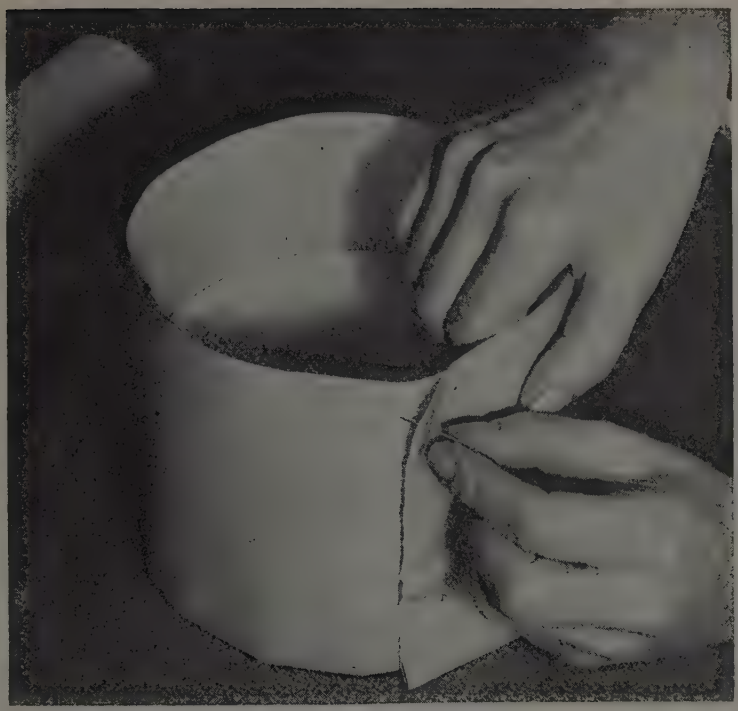
Passion Fruit Cream

This a very good pudding when passion fruit are plentiful.

½ oz. of gelatine
6 oz. of sugar
8 oz. of hot water
3 egg whites
6 oz. of cold water
Juice of ½ lemon
Juice of 12 passion fruit, strained

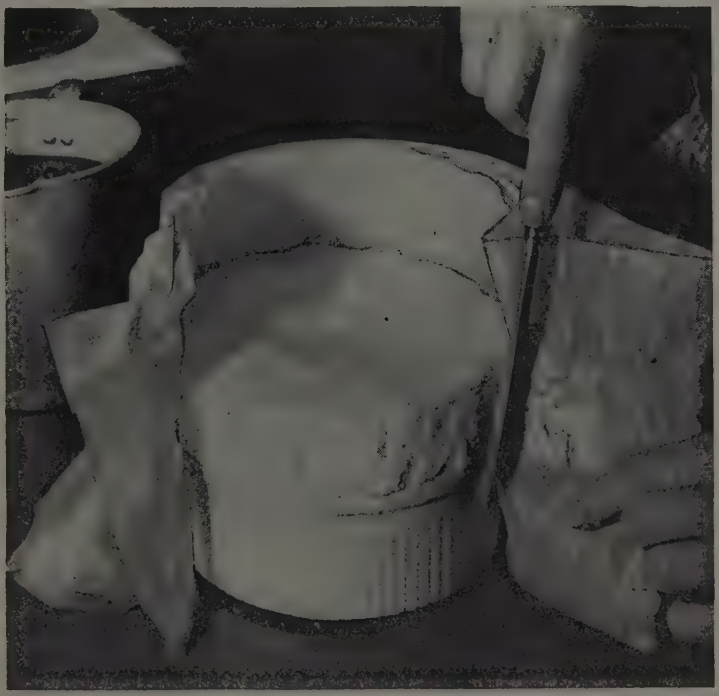
(6 servings)

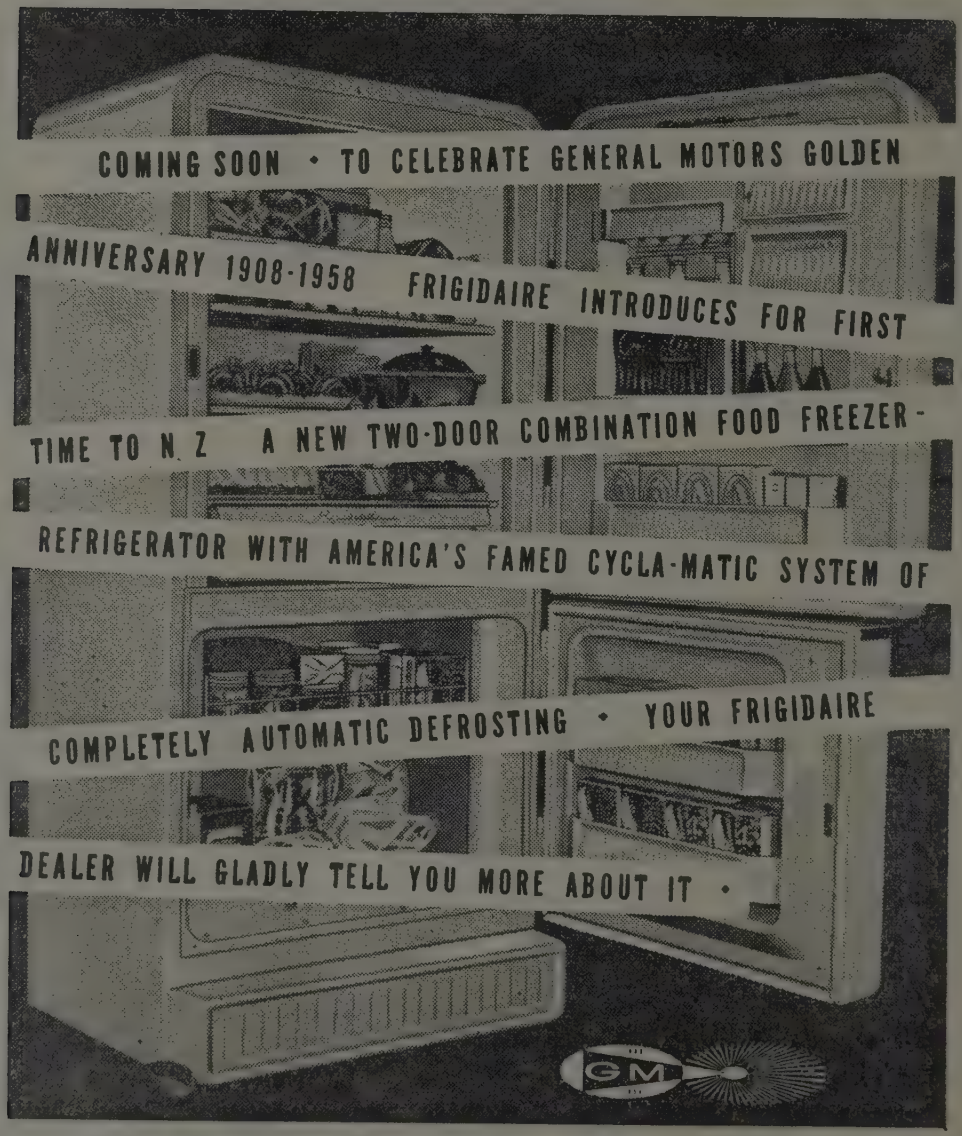
Soak the gelatine in the cold water. Boil the sugar, hot water, and lemon juice for 5 minutes. Add the gelatine and when cool fold in stiffly beaten egg whites and the passion fruit juice.



▲ Preparing souffle dish.

▼ Removing paper case from souffle dish.

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Pineapple Cream

11 oz. tin of pineapple
6 oz. of cold water
4 tablespoons of sugar
2 tablespoons of gelatine
Grated rind and juice of ½ lemon
1 cup of whipped cream

(6 servings)

Soak the gelatine in the water for a few minutes and then dissolve over low heat. Add the pineapple (chopped), pineapple juice, and lemon juice and rind. Put aside until it begins to set; then add whipped cream and stir thoroughly. Leave to set.

Norwegian Trifle

2 cups of water
4 tablespoons of sugar
2 eggs
1 tablespoon of gelatine
1 large lemon

Soak the gelatine in ½ cup of cold water and boil the rest of the water. Beat the egg yolks with the sugar. Add the juice and grated rind of the lemon and mix with the boiling water and the soaked gelatine. Leave to cool, then fold in stiffly beaten egg whites. Pour into a dish and when set spread with a thin layer of raspberry jam and cover with whipped cream.

Lemon Chiffon Pie

Biscuit crumb crusts make a very pleasant change from pastry. They are an ideal base in which to set some gelatine desserts, and for a special pudding chocolate biscuits can be used in place of wine biscuits.

Base

½ lb. of wine biscuits
4 oz. of melted butter
or
½ lb. of chocolate biscuits
3 oz. of melted butter

Crush the biscuits until they are the consistency of fine breadcrumbs and then combine them with the melted butter. Press into a glass ovenware plate and leave in a cool place overnight or in a refrigerator until firm.

Filling

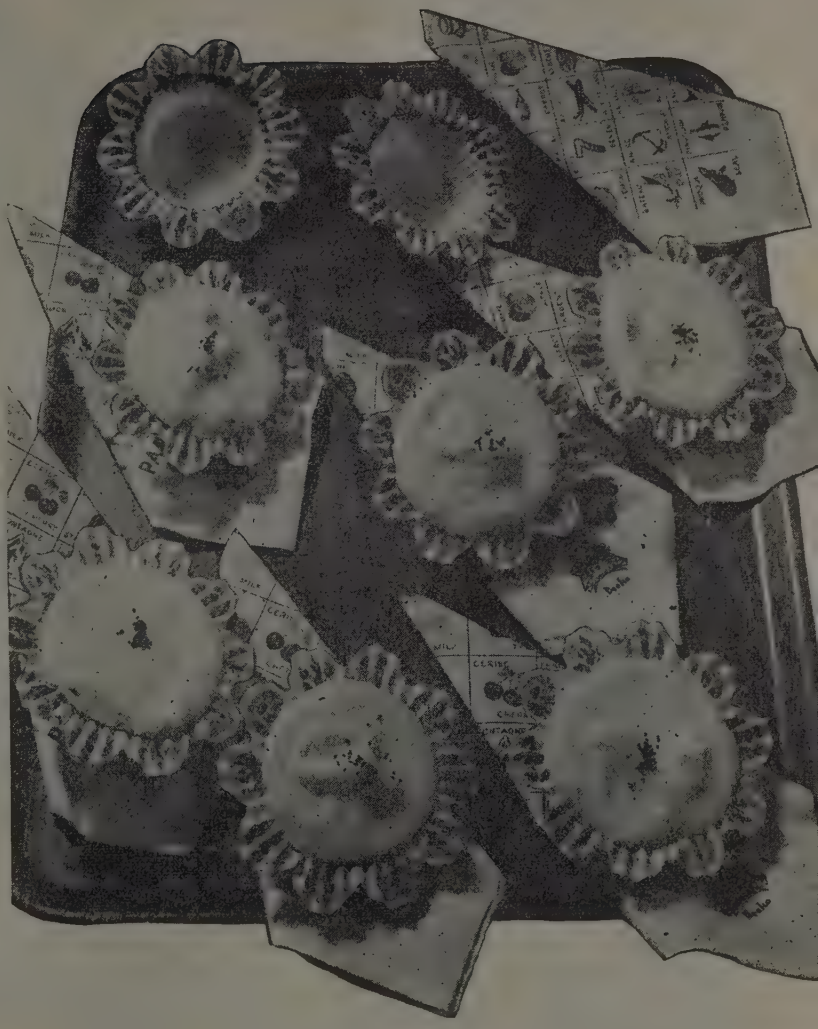
½ tablespoon of gelatine
2 oz. of lemon juice
½ teaspoon of lemon rind
2 eggs, separated
4 tablespoons of cold water
2 oz. of sugar
1 oz. of sugar

Soak the gelatine in cold water. Beat the egg yolks and the 2 oz. of sugar; then add the lemon juice and cook over hot water until thick. Cool slightly, add the softened gelatine, and stir until dissolved. Add the lemon rind and cool until beginning to set round the edges. Beat the egg whites until stiff and gradually beat in the 1 oz. of sugar. Fold the gelatine mixture into this and pour into the crumb crust shell and leave to set.

Butterscotch Sponge

1½ tablespoons of gelatine
2 tablespoons of butter
12 oz. of hot milk
Pinch of salt
2 oz. of cold water
6 oz. of brown sugar
3 eggs, separated
½ teaspoon of vanilla

(4 to 6 servings)



Waxed paper cases are ideal containers for individual sweets, especially for children's parties or for picnics.

Soak the gelatine in the cold water. Melt the butter and brown sugar in a heavy frying pan and then add the hot milk. Pour this over the beaten egg yolks and beat in a double boiler until starting to thicken; do not boil. Add the gelatine and stir until dissolved; leave to cool. Beat salt and egg whites until stiff; fold into the butterscotch mixture and leave until set.

Flummery

This pudding is an economical one. However, it does require a lot of beating and, therefore, will be appreciated more by the owners of electric mixers.

1½ tablespoons of flour
1½ tablespoons of gelatine
6 oz. of sugar
Juice of 1 lemon
8 oz. of water
6 oz. of water
Juice of 2 oranges
6 passion fruit (if available)

(6 servings)

Soak the gelatine in 6 oz. of water. Mix the flour and the 8 oz. of water to a smooth paste. Combine the two and add the lemon and orange juice and sugar. Bring all to the boil for a few minutes. Cool, until starting to set, and then beat for 10 to 15 minutes. Fold in the passion fruit pulp and leave to set.

Photographs by Sparrow.

Brighter Bench and Table Tops

By ELEANOR S. CAMPBELL,
Home Science Instructor, Department of Agriculture, Auckland

GOOD colour schemes and pleasant interior decoration play an important part in every home. Front rooms and living rooms may first catch the eye, but the kitchen is a very important part of the house and deserves as much thought in colour as any other room. However, major redecorating changes may not be needed or wanted, but if some smaller change would benefit the room, new tops for benches or tables may provide the desired effect.

MATERIALS suitable for bench and table tops and for coverings for other flat surfaces are:

Stainless steel—can be moulded into sinks or sink-bench units complete.

Laminated plastics.

P.V.C. (polyvinylchloride) coated fabrics.

Linoleums.

When choosing material for a new bench or table top, or even for a complete new sink unit, it is as well to bear in mind the following:

1. Hardiness and durability.
2. Ease of cleaning.
3. Non-absorption; stain and water repellancy.
4. Scratch and abrasion resistance.
5. Heat resistance.
6. Resistance to fats, acids, or alkalis.
7. Appearance, colour, and cost.

Stainless Steel

Stainless steel sinks and sink benches have been in vogue for some years. Stainless steel ranks highly in desirable qualities, particularly in heat resistance and ease of cleaning. As the whole unit is moulded from one piece of metal, there are no seams, cracks, or joins which may harbour dirt or insects.

Approximate sizes only of these units can be given, as they may vary in different places. Generally, however, units consisting of sink, sink bench, and back splashboard come in three sizes—5 ft., 5½ ft., and 6 ft. in length and 20 in. wide.

As this type of bench will last a lifetime, it is wise to be sure of getting the exact type and size wanted. If the sink is to be placed under a very sunny window, it is as well to remember that the sunshine coming on to the bright metal can cause quite a glare.

Laminated Plastics

Such tremendous strides have been made in the development of plastic materials in recent years that they are finding their way more and more into normal household equipment. Among the plastic materials are the laminated

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HEADING PHOTOGRAPH: Stainless steel sink and bench moulded from one piece of metal. It has good drainage channels into sink.

plastic veneers, which are much used in both industry and in homes on flat surfaces such as bench tops, table tops, walls, doors, and cupboards.

Laminated plastic veneers are made by several different firms and sold under various trade names. They do not all have the same density, strength, or heat resistance, so it is wise to be sure of these qualities before buying.

If the material is to be used on a surface that will get a great deal of hard wear, such as bench top or kitchen working table, it is best to buy from well known firms and to inquire if any guarantee is given for heat resistance and colour fastness. If a firm will guarantee its product, it should be reliable.

Laminated plastics are made by many layers of paper or fibre bonded with treated resins. The second to last layer of paper bears a printed pattern and there is thus an almost limitless choice of colour, design, and pattern. A transparent top sheet impregnated with another special resin is applied and the whole put under tremendous pressure and carefully controlled heat. The finished sheet is a rigid, non-absorbent veneer which can be applied to certain flat surfaces.

Two types of surface finishes, glossy or matt, are available. The glossy finish is best for a surface which may have liquids spilt on it, as they are very easily wiped off. However, the non-reflecting, matt finish is also non-smearing and easily cleaned.

This type of surface can usually be cleaned with a damp cloth or by washing with hot soapy water. Harsh scouring powder should never be used. Rubbing with a soft cloth and detergent powder will usually suffice to remove the occasional stubborn stain. There is no need to polish this type of plastic; in fact wax polishes in time will collect dirt and give a dull look.

Qualities of Laminated Plastics

Laminated plastics are hard wearing, provided a good-quality plastic is used. They are easy to keep clean and are resistant to corrosive liquids likely to be spilt on them. They are reasonably scratch resistant; that is, they will stand up to the normal wear and tear of kitchen work.

Heat resistance may vary with the type bought. It is wise before buying a certain material to find out to what degree it is heat resistant. A good laminated plastic veneer should be resistant to well above the boiling point of water (212 degrees F.). Plastics are available which will withstand heat up to 266 degrees.

This should be sufficient for most kitchen wear. Boiling liquids spilt on it should wipe off, leaving no mark, and hot plates or dishes could be placed on it without harming it. However, dishes or pots straight from the stove or oven should not be placed directly on this surface, nor should hot irons, as the concentrated heat may tend to scorch or blister.

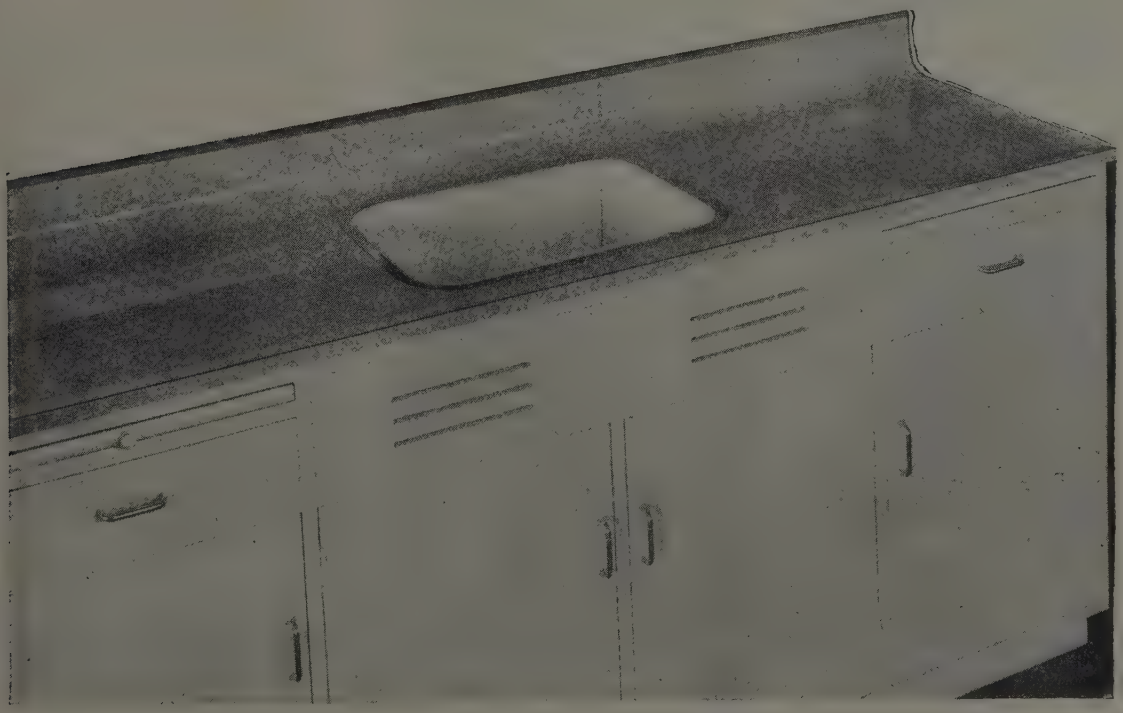
If laminated plastic is used as a splashboard at the back of a stove, it is wise to make sure that the back elements or gas rings are far enough away from the splashboard to prevent the heat from scorching the surface. Steam from cooking utensils will not do any harm and splashes of fat or food are easily wiped off.

Buying Laminated Plastic Material

How laminated plastic is bought will depend on the use to which it is to be put. If it is for a sink bench, there are several ways of buying.

A whole unit (sink, bench, splashboards, and cupboards underneath) can be bought and installed.

Sink bench units only are available. These are made in various lengths



Moulded laminated plastic sink bench with enamel sink inset.

Laminated plastic sheets can be bought and glued to suitable surfaces. They are available in standard sizes (front piece) or off-cuts, which are slightly cheaper per square foot.

from approximately 5 ft. to 6 ft. long. Some firms will mould a sink bench to the purchaser's own specifications.

Sheets of the plastic veneer in certain stock sizes may also be bought and can be glued to the surfaces desired in the home. Explicit and detailed instructions for this work are printed by many retailers and to obtain satisfactory results it is wise to follow these instructions very carefully.

Using the wrong kind of adhesive or trying to glue the veneer on to an uneven surface or one too light and flimsy will prove a waste of time, material, and money.

P.V.C. Fabrics

P.V.C. coated fabrics, sold under various trade names, make suitable coverings for benches, tables, or cupboards. The materials are pliable and are generally sold by the yard. Many different colours and designs are available.

They are hard wearing, impervious to water, and fairly heat resistant, though they will not withstand as much heat as some of the laminated plastics.

The material is quite easy for anyone to apply to a clean, smooth surface. However, printed instructions are given for the application of some materials, and they should be followed. The correct type of adhesive should be used, and if heat is applied, the correct temperature should be used.

However, once the bench or table, etc., is covered with the material it provides a colourful, hard-wearing top, which is easily kept clean. A wipe with a soft, wet cloth should be enough to keep the top clean. Acids, fruit juice that stains, or fats liable to be spilt on this fabric can be wiped off without damaging it. However, any petroleum derivative, such as kerosene, spilt on the fabric may stain and damage it.

There are different brands of this type of material, some being thicker and more hard wearing than others. Some are sold by the yard in 36 in. widths.

Another kind of P.V.C. fabric is available for shelf-coverings. It is thinner and would not withstand heavy wear and tear, but is perfectly suitable for places such as shelves or tables which are not used greatly for kitchen work.

This kind is very easy to apply, as it has an adhesive backing, which is covered with paper when bought. The material can be obtained by the yard in 18 in. widths. All that is necessary to apply it is to see that the surface on which it is to go is smooth and clean. The paper backing is removed and the fabric pressed firmly and evenly over the whole surface, care being taken to press out any air bubbles. All these coverings are available in a wide range of colours and plain or patterned. They can be used to provide a bright and colourful atmosphere.

Linoleums

Linoleum is not impervious to water and therefore not very suitable for a sink bench, as it is very hard to prevent water seeping in round the sink. It can be used satisfactorily on a table if well set in with a beading round the edges.

Plastic Linoleum

However, a vinyl plastic linoleum is now available which is non-absorptive and can therefore be used for both sink benches and table tops. It also needs to be set in with a beading round the edges. However, it is extremely hard wearing, acid resistant, waterproof, and does not crack or perish. It can be bought in various colours by the yard in 36 in. widths.

Vinyl plastic linoleums will withstand hot or boiling liquids spilt on them. However, as with most plastics, concentrated heat, such as from dishes or pots taken straight from stove or oven, tends to mark the surface or may even cause the linoleum to lift. Kerosene or other petroleum derivatives harm this material (and most vinyl plastics), but it is resistant to most other things with which it is likely to come in contact in a kitchen.

This type of plastic linoleum must be glued to the bench or table surface with a waterproof, spirit cement.

Though the linoleum is hard wearing and will stand up well to normal use, it is not wise to have it on a cutting or chopping board.

Man-made materials have done much to bring colour and brightness into the home and to cut down time and effort expended in keeping the place clean. Used and treated with reasonable care they should give lasting service, at the same time providing a decorative touch in working areas.

Photographs by Sparrow.

Australian Shrubs for Flower Garden

WARATAH, wattle, bottlebrush, and boronia immediately bring Australia to mind, but these are the forerunners only of a host of Australian shrubs which are gradually becoming available to New Zealand gardeners and which in time will be equally well known. In this article J. S. Say, Horticulturist, Department of Agriculture, Auckland, discusses the cultivation of Australian shrubs and describes some of the newcomers which have proved themselves under New Zealand conditions. The notes on garden work for May are by Rosalie A. Campion, Horticultural Instructor, Department of Agriculture, Wellington.

GARDENS in New Zealand are slowly but surely changing. They are becoming smaller, more simple in design, and greater emphasis is being placed on easily maintained permanent plants. Another change, which is likely to be revolutionary, is the gradual replacement of shrubs from Europe, North America, and temperate Asia by plants from Australia and South Africa.

Provided soil conditions are suitable, a very wide range of Australian shrubs may be grown not only in the warm, temperate parts of the Auckland Province but also in the milder areas of Hawke's Bay, Nelson, Palmerston North, Wanganui, the hills and bays around Christchurch, and the valleys of Dunedin. A limited range of more hardy species such as waratah, callistemon, and grevillea may be grown in all but the coldest districts.

Habitats and Characteristics

Until the last few years most Australian shrubs grown in New Zealand came from the eastern highlands of Australia. Waratahs and many of the bottlebrushes, mints, and grevilleas are examples of these.

The main introductions are now coming from the south-west of Western Australia where the rainfall is generally lower and where the soil, always well drained, ranges mainly from sandy to gravelly.

Some are from coastal regions and others are from the inland ranges where frosts may be experienced. In general, plants from this area will stand drier conditions than those from the east and are classed as half hardy. Most are fairly wind resistant.

The plants are noted for the colour of their flowers, which ranges from soft pastel shades to brilliant golds, orange, and scarlet and intense blues which are seldom seen in the flora of other parts of the world. Sometimes the colours are in startling combinations, as for example the red and green, yellow and black, or orange and purple of some of the kangaroo paws.

Foliage is typical of plants growing in dry areas, being thin and needle like, thick and felted with hairs, or coarse, hard, and leathery, and this makes many of them worth growing for foliage effect only. Growth habits are extremely variable and range from dense ground covers to light, open shrubs with attractive weeping forms.

Soils

In dealing with a range of different genera and species such as those found among Australian native shrubs it is difficult and not advisable to generalise too freely on their cultivation. However, there is one point which is common to most of the species available in New Zealand. They must have perfect drainage and the drained area must extend downward for 2 ft. or 3 ft. or more if possible. Though they may survive for a period in soils where only the top few inches is well drained, death usually follows fairly quickly when the roots get down into wet areas. Good drainage is essential even for those species which require fairly moist root runs, for few can withstand stagnant conditions.

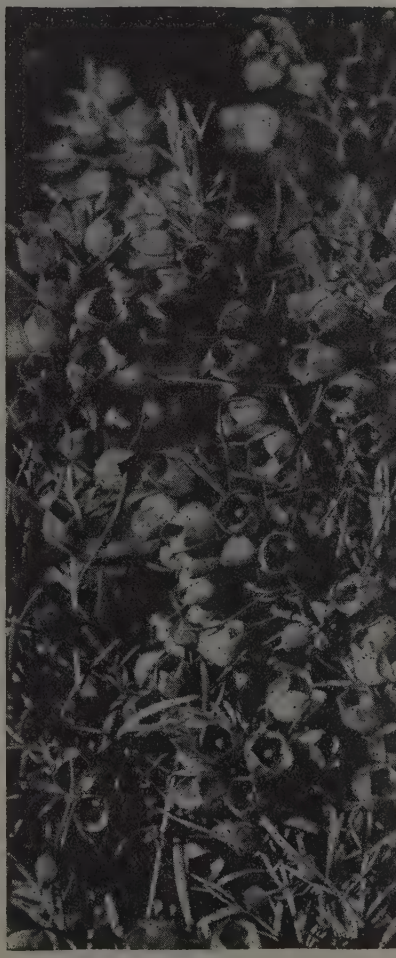
It has already been mentioned that many of the most desirable shrubs grow naturally in sandy or gravelly soils. Under cultivation it is not necessary to duplicate these exactly. The majority can be grown on a wide range of soils provided drainage is adequate and heavy soils are deeply cultivated.

There is also a second factor regarding soil conditions which is generally applicable. It should contain a fairly high proportion of organic matter. In light soils this is necessary to conserve moisture and to provide a cool root run, while in heavy soils it helps to promote good drainage.

Most Australian shrubs do not need a rich soil for they are not gross feeders, and many will thrive on soil which would be considered too poor for the general run of garden plants.

Position

A study of the habitat of the shrubs also gives an indication of the best positions. Those from the west grow mainly in open country or under the shade of tall, sparsely branched trees such as gums, and they frequently grow in colonies. Under cultivation they are best in a warm, sunny, open situation where there is a free movement of air about them, but it is often considered that they do better when planted in small groups. In garden planning, groups, especially of the smaller species, are far more effective than single specimens.



Boronia heterophylla.

Uses in the Garden

A consideration of the soils and positions where Australian shrubs grow naturally gives an indication of the many ways in which they may be used in the garden. They are ideal for sandy seaside sections and sections with light, open, free draining soils and for banks or slopes with heavy soils in hot, sunny positions where it is often difficult to get other shrubs or lawns established. The former is an obvious use but the latter may seem contradictory. In such positions heavy soils are usually fairly well drained in that they never have water lying on them and do not have a high watertable, or drainage can be fairly easily

[Elliott

▲ *Boronia megastigma.*

▼ *Regelia grandiflora* grows to about 6 ft. and bears bright red flowers in spring. It likes a light soil on the coast and will stand wind, but is frost tender.

provided to give these conditions. Slopes lying to the sun are warmer than a flat section and slopes also allow a freer circulation of air through plants growing on them. Cold southerly slopes are not suitable.

Slopes too steep for normal planting may be covered with scrambling or prostrate shrubs, which are also useful for draping over walls or growing on difficult rocky sections or in rock gardens.

Many have great possibilities as hedge or shelter plants, both trimmed and informal. They are very useful in shrub and mixed flower borders, as many flower when flowers are rather scarce. A number are suitable for cutting.

Planting and After Care

Planting may be done in winter in frost-free areas or in spring where frosts are experienced. The position should be thoroughly prepared well in advance by draining where necessary and by deep digging especially on heavy soils. Organic matter such as well rotted compost or cow manure should be worked in through the soil when the position is prepared. It should not be put in the bottom of a trench in a layer. Fertilisers are not generally necessary, but on very poor soils a light dressing of blood and bone may be hoed in just before planting.

As many Australian shrubs, especially those from the west, do not transplant well, it is best to buy small plants grown in containers so that they can be set out with the minimum of root disturbance.

It is usually advisable to stake them to hold them firm until they are well established, and to protect them against strong winds and frosts in exposed situations, for many are tender in their young stages. Watering should not be neglected, especially during the first summer, for, until they have established good root systems, they cannot stand severe drying out. Even established plants of species known to stand very dry conditions will suffer in prolonged dry spells.

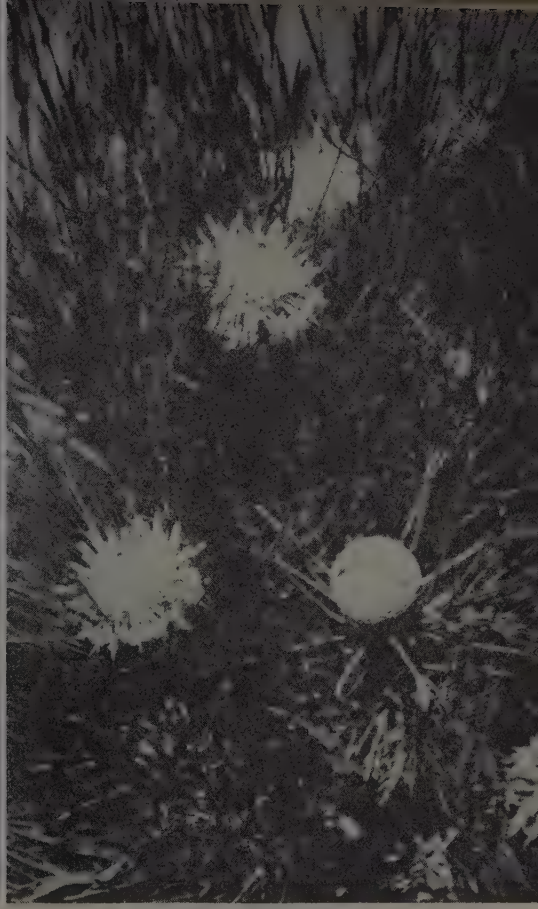
Maintenance

Deep cultivation should be avoided, as most Australian plants resent any root disturbance. Cultivation should be limited to light hoeing. Mulches help to conserve moisture and provide a cool root run, but they can cause trouble unless used with care. They should not be applied too thickly or allowed to touch the stem. Coarse sawdust and wood shavings are good. Scoria and gravel up to ½ in. in diameter have proved very satisfactory. Materials such as partly decayed compost or animal manures and fresh lawn clippings can induce stem rots, but supply small amounts of plant food. They should be applied only in summer in quantities which will rot down before winter.

Pruning

Pruning is necessary to promote flowering and to maintain the shape of those Australian shrubs which tend to have a rather open, leggy habit. It

▲ *Hakea laurina.*



▲ *Isopogon anethifolius.*

presents problems, as the normal rules for pruning flowering shrubs are not entirely applicable.

Most gardeners are familiar with leggy waratahs and bottlebrushes which have become rather unattractive in spite of their many flowers. Pruning and shaping before they reached flowering size would very largely have prevented this. Young plants of species which are known to become bare at the base as they grow older should be lightly pruned when young by the removal of the tips to promote side growths and a bushy habit. When maturity is reached pruning is best done immediately after flowering by the removal of the spent blooms. This is important with waratahs and bottlebrushes, which shoot quite readily from beneath the old flowers provided the flowers are picked either when still fresh or immediately they begin to fade. This will encourage more flowers the following year with less bare stem.

With most other Australian shrubs the general rule is to prune lightly and often and to avoid cutting back into old wood which carries little or no leaf.

The following is a selection of Australian shrubs which are either newer introductions or are not as well known as they deserve to be:

Acacia

A. baileyana with its golden flowers and greyish foliage is well known, but there are many others equally decorative. Some which do not grow as large are:

A. cultriformis grows to about 8 ft. and flowers over a long period a little later than *A. baileyana.* The triangular leaves are bluish and the golden balls of flowers are produced in large clusters. Suitable for coastal planting. Good as a specimen or background effect.

A. spectabilis grows 8 to 10 ft., with feathery foliage and long heads of golden balls. Likes a heavier but well drained soil and is best inland.

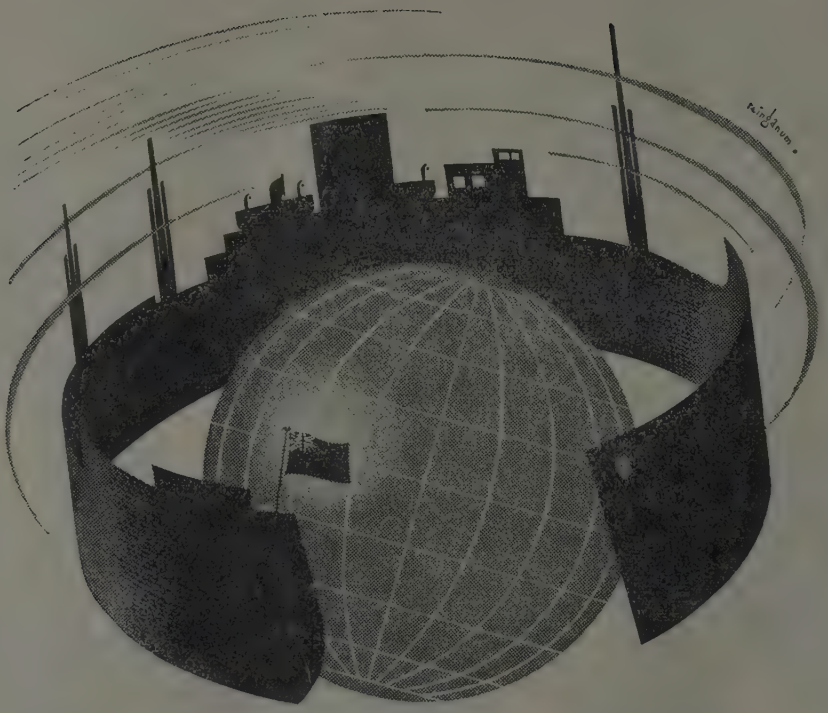
A. riceana forms a dense, compact bush 6 to 8 ft. high with small, creamy-yellow rod-shaped flowers. Prefers a moist position.

Agonis juniperina

Agonis juniperina is an extremely fast-growing small tree of graceful habit which is excellent where a quick effect or shelter is needed. In winter it is smothered with very small tea-tree like white flowers. Good for cutting and with judicious pruning can be kept as a moderate to tall shrub. Very good for seaside planting and not very particular about soil.

Anigozanthos

Anigozanthos or the kangaroo paw of Western Australia is not a shrub but a herbaceous perennial with grass-like foliage. A well grown plant in full bloom will make a striking feature in a shrub border or in a mixed planting and in certain situations can be used as a specimen plant. The flowers are quaint rather than beautiful, woolly, and in many cases gaudily coloured. They flower from late winter to summer. They require a moist, well drained soil with full sun. A well drained sandy swamp soil is ideal, but they will do well in heavy soils provided drainage is good. Only two or three species are generally available



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In 1939 the operating expenses arising out of a round voyage were around £57,000. Today they are about £240,000 — over four times as much. The cost of running New Zealand's shipping service is therefore in excess of £30,000,000 annually.

That is the figure on one side of the ledger, a figure that is the total of many separate items — labour costs, fuel costs, port dues and so on.

On the other side there is only a single item: the money you pay in freight rates and passenger fares. And these charges are *not* running at a level of more than four times as much as they were in pre-war years. Everything possible has been — and is being — done to offset the continuing rise in operating costs, with the result that the average of freight rates today is only just over three times as much as it was before the war.

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at present, but some of the more colourful ones will be coming on the market within the next few years.

A. viridis grows to 2 ft. Flowers bright green.

A. manglesi is a strong-growing species up to 3 to 4 ft., with green flowers and red stems.

A. flavidus grows to 6 or 8 ft., with yellowish-green flowers in spring and summer. They are useful for cutting and look well even when dried. It is the easiest one to grow.

Baeckea

Baeckea linifolia grows to 5 to 6 ft. and has arching sprays of tiny white flowers in summer and is good for cutting. Best in a light soil and does well on the coast.

B. crenatifolia has small white flowers in spring and is good for light soils in windy situations.

B. virgata is summer flowering and good for cutting. Something like *Thryptomene.*

Boronia

Boronias require a light, well drained soil which should not be allowed to dry in summer.

B. megastigma has strongly scented brown flowers.

B. denticulata has mauve-pink star-shaped flowers, which smother the 3 to 4 ft. bush in spring. Suitable for most positions.

B. elatior has pink flowers for about 3 months in spring. Grows to 4 ft. Flowers are not scented, but the foliage is slightly aromatic.

▲ *Melaleuca nesophila.*

B. heterophylla is the showiest of all boronias. It is smothered in deep pink flowers in late spring; slightly scented. Likes a moist but well drained loamy soil. This boronia can be regarded as being more permanent than the previous species and may last more than 10 years if looked after.

Calocephalus browni

Calocephalus browni is a dense, compact, twiggy shrub with very small silvery-grey leaves and stems. It has small yellow flowers, but its chief value is for foliage effect. Forms a cushion about 12 in. high.

Chamaelaucium uncinatum

Chamaelaucium uncinatum (Geraldton wax flower) is a native of the sandy areas of Western Australia. It grows to 5 or 6 ft., with a light, open, slightly pendulous habit with dainty foliage. The flowers in spring are pink, very waxy in texture, and the shape of a large tea-tree flower. As the flowers vary in colour when grown from seed, it is as well to buy plants grown from cuttings of a good strain. Likes a light, well drained soil, and in New Zealand seems to do best where it has a cool root run, but with plenty of heat at the top, for example, against a sunny wall.

Dodonaea

Several species of dodonaea have ornamental seed vessels which remain

▼ *Dryandra formosa*, a tall shrub very suitable for a hot, dry position. It flowers in winter and has very attractive foliage. Elliott photo.

▼ *Beaufortia sparsa* has bright red flowers in summer and likes a well drained position. Elliott photo.

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on the bush for months. Those most grown include *D. truncatiales*, *D. lobulata*, and *D. cuneata*. All about 6 ft.

Frankenia pauciflora

Frankenia pauciflora forms a mat about 1 in. high and 18 in. to 2 ft. across. Small leaves and small mauve-pink flowers in spring and summer. A native of coastal areas, it is very good for covering sandy banks.

Grevillea

A wide range of species of grevilleas is under cultivation, from dwarf, prostrate shrubs to large trees. The silky oak (*G. robusta*) and the rosemary grevillea (*G. rosmarinifolia*) have been grown in New Zealand gardens for many years. Some of the newer introductions which can rival most shrubs for a colourful display are:

G. lavandulacea Black Range Form grows to 1 to 2 ft. and is somewhat spreading. It bears masses of bright red flowers in spring.

G. fasciculata is a prostrate shrub suitable for banks and ground cover. Orange-red flowers in autumn and winter.

G. punicea is a compact shrub growing to 5 ft., with red spidery flowers in clusters. Other good species are *G. hookeriana*, *juniperina*, *banksi fosteri*, and *williamsi*.

Hakea laurina

Hakea laurina has pink and cream pincushion flowers about 2 in. to 3 in. across. Will not stand wet soils and seems to flower freely only in hot, dry positions. Grows to 5 ft. to 6 ft.

Hibiscus huegeli

Hibiscus huegli is a bushy shrub from South and Western Australia, with large rather loosely formed mauve flowers in summer. The leaves are soft and deeply divided. It is suitable for dry and somewhat sandy soils.

Hovea pungens

Hovea pungens is a small shrub with blue pea-shaped flowers in winter and spring. Good for sandy soils on the coast.

Hypocalymma robustum

Hypocalymma robustum (peach myrtle) is a shrub about 2 ft. to 3 ft. high from Western Australia, with small heath-like leaves and rose-pink flowers something like a double peach in winter. Must have a very light soil near the coast. A little difficult to grow, but well worth a trial by enthusiasts.

Isopogon

Isopogon cuneatus is an upright bush 3 ft. to 4 ft. high, with large mauve-pink chrysanthemum-like flowers in spring. Appears to be suitable for most soils.

I. roseus has rose-pink flowers and stiff, finely cut blue-green foliage, which is rather attractive.

I. anethifolius has yellow cones and feathery foliage with a bronze tinge. Grows to about 3 ft. and likes a light soil.

Kunzea

Kunzea recurva montana has fluffy yellow flowers in spring. Grows to 5 ft. to 6 ft. and seems adaptable to most garden conditions.

K. ambigua has white fluffy flowers about Christmas time on arching branches. About 4 ft.

Lambertia ericifolia

Lambertia ericifolia is an upright shrub growing to 6 ft. or 8 ft., with orange trumpet flowers and heath-like foliage.

Leschenaultia biloba

Leschenaultia biloba is a small shrub about 12 in. high, bearing in spring and summer masses of flowers of an intense blue. Though a native of the

▼ *Acacia drummondi*, a compact shrub about 4 ft. high, bears pale yellow flowers in spring. Elliott photo.

▼ *Thryptomene calycina*. Elliott photo.

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gravelly soils of the Darling Range, it will do well on heavier soils provided drainage is perfect. For the greatest effect should be planted in groups.

Melaleuca

Melaleuca is a fairly large genus of attractive garden plants, of which *M. lateritia* is the only one grown to any extent so far in New Zealand. Known as the robin redbreast shrub it is a slender plant up to 10 ft. high, but at times becomes rather leggy. The dainty bottlebrush flowers, borne in profusion in spring and summer, are orange-scarlet. A loamy soil is best, but it will do as well on other types.

M. radula in winter and spring bears on arching stems flowers of a good mauve colour tipped with gold. Prefers a light to medium soil and is good for coastal conditions. Would make a good hedge plant and grows 5 ft. to 6 ft. high.

M. nesophila is a species with mauve flowers in summer and is good for coastal planting. About 8 ft. high.

M. incana has soft greyish foliage with a delightful weeping habit and is very attractive when not in flower. It has yellow bottlebrush flowers in spring and grows to 6 ft. to 8 ft. Good for coastal conditions.

M. elliptica bears carmine flowers in spring and remains in flower for about 3 months. Would make a good hedge plant. Prefers a light soil and is good for coastal planting.

Myoporum debile

Myoporum debile is a low, spreading shrub with small pink flowers in spring followed by showy, white or purple succulent fruit. Makes a good ground cover, but will not stand very dry conditions and is best inland.

Pimelea

Pimelea spectabilis is another Western Australian shrub growing 2 ft. to 3 ft. high, with globular heads 2 in. to 3 in. across of small tubular flowers in spring. They are creamy but tinged with pink and are borne in profusion even by small plants. They may not be long-lasting plants, but their beauty makes up for their comparatively short life. They prefer sheltered positions with some shade and summer moisture and are suitable for coastal planting.

P. rosea is a smaller and rather spreading shrub with pink flowers.

P. ferruginea is a dense hebe-like shrub with pink flowers about 1½ in. across in spring. Grows to 2 ft.

Thryptomene

Thryptomene calycina is becoming more widely planted as its worth becomes recognised. It grows 3 ft. to 4 ft. high, with an attractive arching or spreading habit, and in spring is smothered with tiny white flowers which turn to pink. It is a native of rocky soils in Victoria, but does well in most gardens provided drainage is good.

[*Elliott*

Pimelia spectabilis.

T. saxicola rosea is similar to *T. calycina* but with pink flowers and more open habits.

T. stenophylla has pink flowers, but with a prostrate habit and forms a low-growing mat about 3 ft. across. It makes an excellent ground cover and is good for rock gardens or for trailing over walls.

Garden Work for May

Most gardeners will find this month the most suitable for setting mixed borders in order and renovating them after their prolonged flowering period, but attention should also be given to correcting or improving drainage and stabilising paths before the winter sets in.

In the Border

When the last of the flowers in the mixed border fade, the tops should be removed close to ground level. This material should be removed to the compost bin or, if very woody or diseased, to the incinerator. Any but the most experienced gardeners can fail to recognise plants in their dormant stage and it is wise to check all labels when the tops are removed.

Beds containing mostly herbaceous perennials need to be replenished every 2 to 3 years to keep the plants growing vigorously. However, clumps

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THERMOSTATIC CONTROL

of helenium, rudbeckia, helianthus, golden rod, and michaelmas daisy usually need breaking up each year; otherwise they degenerate and the flowers become smaller. Conversely, some subjects which do not make fibrous roots react unfavourably to disturbance and should only be lifted and transplanted if the blooming has deteriorated. This group includes paeony, gypsophila, dictamnus, kniphofia, geum, and *Romney coulteri*.

Other plants should be lifted and placed on sacks beside the border, where they can be divided and the outside pieces selected for replanting. The labels should be checked during this operation.

Where possible well rotted animal manure or compost should be spread and dug in. It is important with this part of the garden that the digging be deep and thorough, because it is not easy to aerate the soil or incorporate organic manure while the plants are growing. Most New Zealand soils contain a high proportion of silt, which tends to pack down, and even in mixed borders, where only a small area can be done at a time, every effort should be made to incorporate organic matter which conserves moisture and reduces run-off of water.

In years when border plants are not lifted, a mulch of compost or animal manure can be placed around the plants at this time and forked in in spring, when an annual dressing of general, balanced fertilisers should be given.

When lily bulbs are grown in the border an attractive way of marking their position is to plant geums or potentillas above the bulbs and thus allow the lilies to bloom through their light foil of growth. Michaelmas daisies planted around a clump of lilies will fill in when the lilies have finished blooming. Plantings should be arranged so that taller-growing varieties are toward the back; group plantings create a more harmonious effect than specimen plants spaced throughout the border. Colours should also be planned, with the additional thought that white flowers or grey foliage plants merge with all colours and can be used to break possible colour clashes.

Drainage

Before winter sets in drains should be examined and all leaves and debris removed so that nothing impedes the flow of water during winter. Those who are beginning to make new gardens have an excellent chance to drain the area properly before laying out the garden, and in established gardens the owners will be aware of any need for extra drainage. This should be provided now, before the winter rains set in.

The outlet to which excess water is to be drained is most important. If the garden is in a hollow or very flat area, it may be difficult to develop efficient drainage. One alternative is to raise the level of the garden by the addition of soil, compost, etc., and so lower the water table. Outlets will generally be into existing main drains or on to lower ground. In built-up areas water should not be drained on to the neighbour's property without consent. If no suitable outlets exist, a large sump-hole could be dug and filled with large stones to take the drainage water.

Convenient combination of incinerator and compost bins made from old bricks. Both are most useful during the late autumn clean up.

Where tiles are not available drains can be made of bundles of manuka sticks. In most situations it would not be necessary to have drains as deep as the one illustrated, but where roots may interfere with tiles or where it is necessary to take the drainage against the lie of the land to obtain an outlet, this may be necessary.

The addition of sharp sand or sawdust to the topsoil will also assist drainage. Where winter rain constantly beats or drips on to beds surrounding buildings, a 3 in.-deep layer of sawdust with a dusting of blood and bone will stop compaction and allow the water to penetrate gently into the soil.

Preparing New Ground

When new gardens are to be prepared it is most desirable to remove all perennial weeds before planting. In small gardens constant forking and burning is the best method of dealing with couch, oxalis, sorrel, onion weed, and convolvulus. In larger areas TCA or dalapon could be used to eradicate couch, and 2,4-D hormone weedkiller for onion weed and convolvulus. These chemical methods save hard work, but take several months to eradicate the weeds. They must be used with care in established gardens.

New ground should be double-dug to help break up the subsoil and thus encourage a deeper rooting area for the plants. In double-digging the top spit of soil is placed aside and the second spit is then broken up with a fork. The top spit from the next row can then be placed on this forked subsoil and the next lot of subsoil forked. A dressing of garden lime at up to 4 oz. per square yard may be given to all areas except those which are to be planted with rhododendrons, azaleas, ericas, most lilies, and other acid-loving plants.

GARDEN WORK FOR MAY

[*Sparrow*

Brick edges to gravel or sealed paths and drives are neat and easily maintained.

New Rose Beds

New beds which are to contain permanent plant material such as roses, fuchsias, and other shrubs need thorough preparation before planting. Except where the soil is very deep the beds should be double-dug to a depth of at least 18 in. Any available animal manure, stack bottom, seaweed, spent hops, or compost should be incorporated into the bottom spit. This organic matter as well as adding some nutrients will greatly improve the physical nature of the soil. The drainage and aeration of heavy clay soils will be improved and the water and nutrient-holding capacity of lighter soils will be increased.

Paths and Weed Control

Before winter sets in any necessary repairs to pathways and drives should be done. Repairs are usually necessitated by faulty preparation when the paths are first laid down. Paths should always lead purposefully and directly; otherwise they will not be used at all times. Various materials are available for pathing; the most commonly adapted to architecture and surroundings being new or old bricks, natural or manufactured paving stones, fine gravel, asphalt, and coloured or natural cement. Whatever material is used a firm foundation is essential. A 2 in.-to-3 in. layer of gravel, well consolidated, makes a good foundation.

At this stage a soil sterilant should be applied to the path to destroy any weeds. Arsenical weedkillers have long been used for this task and give a good kill. They are very poisonous and every care should be taken to destroy old containers and keep the material well marked and in a locked cupboard.

Compounds based on borates and on urea as well as mixtures containing sodium chlorate are also satisfactory for killing vegetation.

When the surface layer of material is added to a path a slight camber or rise in the centre of the path helps shed the water. Stones, bricks, etc., are best embedded in concrete for a firm finish. On asphalt and gravel paths a solid edging of concrete or bricks improves the appearance and durability.

Cuttings

Cuttings of mature wood, commonly referred to as hardwood cuttings, should be taken now while the ground is still warm rather than in the middle of the winter. The tissue at the base of these cuttings will begin to form new roots immediately and will grow away in spring, much more quickly than later cuttings. Cuttings of deciduous material such as forsythia, roses, philadelphus, and jasmine are generally made 10 in. long. If, as is usual with rose stock cuttings, suckers are not desired, the buds at the base of the cuttings should be removed. A straight cut should be made just below the leaf base and the cutting inserted up to half its depth in an open medium such as sand.

Evergreen cuttings from 5 in. to 8 in. long of hedge plants, abelia, ceanothus, chamaecyparis, cotoneaster, garrya, griselinia, phlomis, and many others can be taken. Short side shoots of the immediate past season's growth with a short heel of older wood are satisfactory. If a shrubby plant is desired, the tip should be removed so that several side shoots develop when growth begins. Conifers should be allowed to develop a single stem.

Seed Sowing and Planting

In milder areas spring bedding plants can still be set out in well prepared and warm positions. These include pansies, *Primula malacoides*, cinerarias, violas, *Allysum saxatile*, wallflowers, calendulas, and polyanthus plants. In sunny places where no more than 10 degrees of frost is experienced outdoor sowings of larkspurs, godetia, clarkia, nigella, cornflowers, and sweet peas can be made in raised or well drained positions. The seeds of several trees will germinate in spring if they are sown now to pass the winter under moist but drained positions. These seeds, which include yew, holly, oak, tulip tree, and silver birch require this cold period before they will germinate, and are best sown in beds or pots of a very sandy mixture.

General

For early summer flowers in the mixed border biennials such as Canterbury bells, sweet williams, foxgloves, and aquilegias can still be planted.

A start can be made on the planting of trees and shrubs where the ground has been previously prepared. Tall trees and standards should be staked at planting against damage by prevailing winds.

Annuals sown earlier should now be thinned out to a flowering distance of about 1 ft. Cineraria plants should be checked for the presence of woolly bear caterpillars and if necessary, sprayed with arsenate of lead, DDT, or lindane.

Old clumps of *Iris innominata* can be divided and replanted on a sunny, well drained slope. No lime or animal manure should be given to this popular species, but on very poor soils the addition of compost is desirable. This plant has a wide range of colours and will give a wealth of blooms over a long period in spring.

The pots of plants such as Kentia palms which remain in their pots for several years should be scrubbed clean and the drainage hole checked to see that it is effective. Pots of fuchsias, geraniums, and balsams can be nipped back to induce bushiness.

Under glass seed of cyclamen, marguerite, chabaud carnations, antirrhinums, and pansies can be sown and lightly covered.

Compost heaps can be turned and covered with boards or galvanised iron to protect them from the drenching winter rains.

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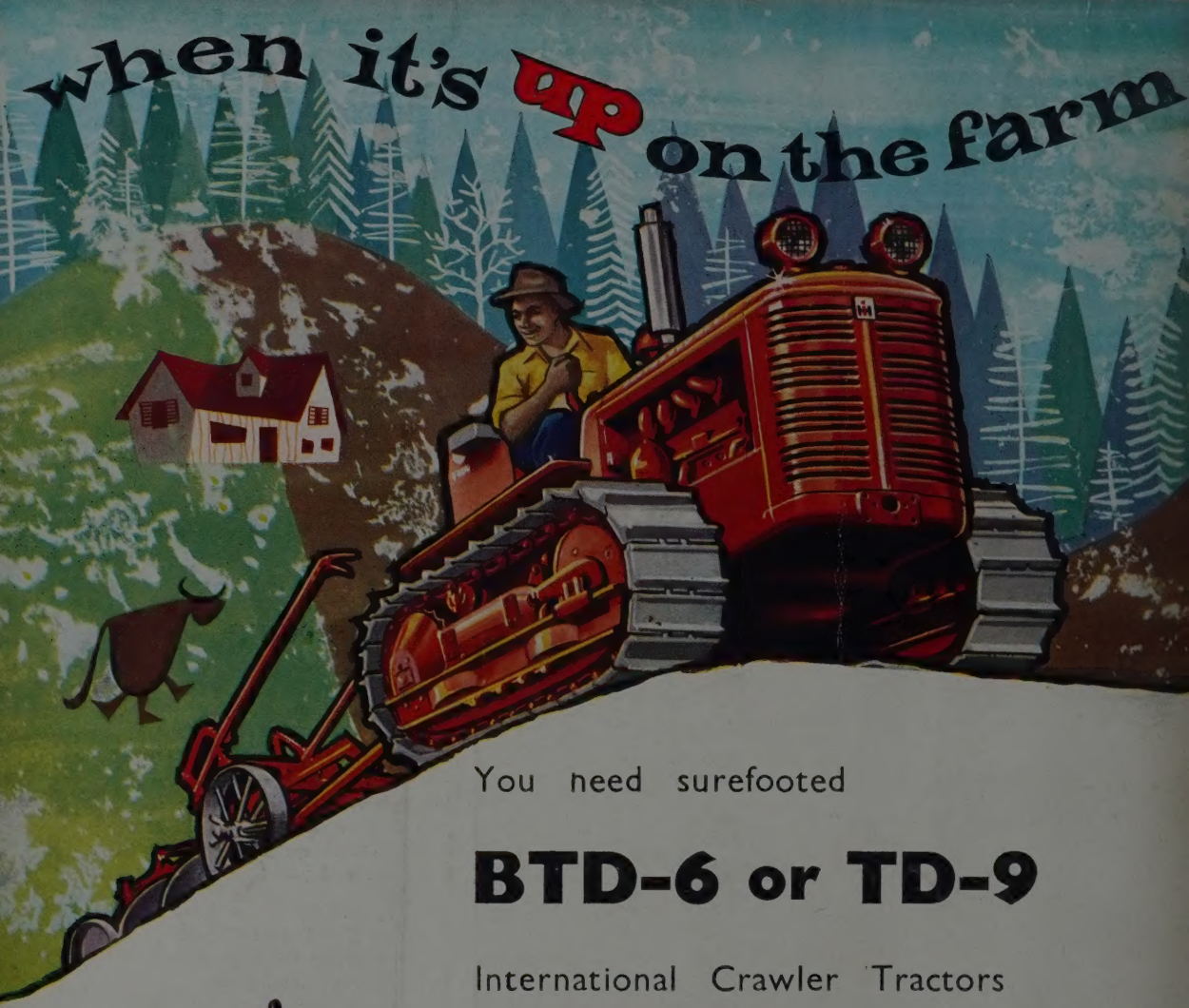

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